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EDITORIALS

THE PRESERVATION OF FOODS BY COLD

THE commercial and scientific aspects of the preservation of foods are so intimately related that no discussion of the one seems possible without including the other. If a food, whether animal or vegetable, has no revenue-producing value when to its preparation is added the cost of its transportation and sale, its surplus supply is allowed to undergo ordinary decomposition, and in this process does often become a nuisance and even a source of expense both to its owner and the municipality in its abatement. De Loverdo, in his work on "*Conservation par le Froid des Denrées alimentaires*," says in the opening sentence:

"*Dans l'histoire des échanges des denrées alimentaires périssables, l'intervention du froid artificiel est destinée à jouer un rôle, à coup sûr, plus considerable que les applications de la vapeur*," which may be interpreted as meaning that the influence of cold in maintaining foods in their normal state

is of much greater importance than the question of whether a freight vessel crossing the ocean from say America to Europe takes one week or one month on the voyage. The problem, however, of food preservation is a much larger one than the mere production of cold, since it involves equally the question of maintaining in cold chambers a proper relative humidity of the air and, so far as practicable, a condition of *asepticism*. Now, were it practicable to introduce all foods in a perfectly sterile or aseptic condition into a storage chamber, it is evident that with a proper humidity the question of cold could be largely eliminated; but it is the practical impossibility of this that makes the application of cold to the preservation of foods of incalculable sanitary and economic value.

THE PART COLD PLAYS IN FOOD PRESERVATION. The popular idea is that cold kills absolutely all vegetable life, including bacteria and fungi; but since liquid air (—190° C.) does not affect certain species, or even boiling hydrogen yet many degrees colder, as fungi grow freely on frozen meat in storage at —10° C. in a saturated atmosphere, and since lichens develop naturally on Arctic snows, it need hardly be said that other elements than mere cold enter into the problem. Yet while this is true, it is most important to realize that any temperature below 50° F. does in practice very notably retard the multiplication of the ordinary germs of fermentation and putrefaction if those other favoring conditions of normal humidity (70° to 75° of saturation) and relative cleanliness or asepticism be present. We may say, then, that to obtain the best possible conditions, a temperature between 32° and 40° F., and a clean atmosphere, having a relative humidity of 70° to 75°, are essential. As microbes, generally, require a moist or liquid medium for their growth, whether on surfaces as *aerobes*, or in deeper tissues, as *anaerobes*, it is plain that they will grow but slowly on dry surfaces or in tissues constantly drying out in the

open air and sunshine, where the ever-moving wind not only renews the air, for instance, about freshly killed meat and boxes of watery fruit, but also causes, as on the western plains or the South African belt, a rapid evaporation of moisture from the tissues. Thus in the preservation of meats, such climates, with their clear, cold nights, supply the three essentials of cold, aseptic air and relative dryness. For instance, the mildest wind, a zephyr at five miles an hour, causes 25,000, and more, changes of air around any object, and with a barometer at 30 inches at sea level, which means a relative humidity of 70 to 75 per cent, we have a *norm* which we must try to reproduce at the low temperature of 32° to 40° F. in a cold chamber. Experience in cold storage has shown that microbes which will grow on frozen meat at 25° F. will not multiply even at 40° F. in clean air with a relative humidity of 70 to 75 per cent. Hence, given an initial cleanness of a food, as great as possible, and the circulation of the air around it, either by a changing of air temperature or by a fan, enabling the air surrounding the food to maintain a relative humidity of 75 per cent, and a cold storage plant is being maintained at its optimum for any temperature determined upon. It, therefore, hardly needs to be remarked that the best or even tolerable results need not be expected if the carcasses of diseased or emaciated animals, or of those badly slaughtered or killed in foul-smelling abattoirs, with dirty knives, by persons with filthy clothes and apparatus; milk even from healthy cows, but having filthy udders, taken by men with unclean hands and soiled clothing, into non-sterile, wide-mouthed pails; butter made from milk infected with various microbes, and not having the water-holding nitrogenous matters in solution well worked out; or fruits, which, though having passed through the dangers of the growing season, are either bruised or rendered filthy in picking and packing, are placed in either stationary cold chambers or refrigerator cars or vessels. The trinity of *asepticism, cold and a*

proper relative humidity, is a sort of *e pluribus unum*, which must in scientific cold storage be our object of reverence and worship.

HOW COLD STORAGE IS OBTAINED. It is manifest, in cold climates like Canada, and many parts of the United States, that it is desirable, wherever possible, to utilize winter ice for cold storage. By it, under best conditions, a temperature about 40° F. may be maintained; but only under the most favorable circumstances and very constant care. Ordinarily, however, owing to a lack of ventilation, or of means for maintaining a proper relative humidity, the advantages of cold from ice are largely lost. Manifestly it is essential that a nearly constant temperature be maintained in the cold chamber, and that the circulation of air within it be regular and definite. Any temperature between 32° and 40° F. seems almost equally good for preserving meat, but not any range of temperature between these two points. How delicate is the matter of relative humidity and of air saturation at low temperatures is learned from the small amount of water vapor which one cubic foot of water at 32 degrees F. will hold.

TABLE OF RELATIVE HUMIDITIES.

Temperature in Degrees Fahrenheit	Grains of Water in 1 Cubic Foot of Air	Temperature in Degrees Fahrenheit	Grains of Water in 1 Cubic Foot of Air
0° F.	.545 grains	60° F.	5.75 grains
10° F.	.841 "	70° F.	7.99 "
20° F.	1.229 "	80° F.	10.94 "
30° F.	1.96 "	90° F.	14.14 "
40° F.	2.86 "	100° F.	19.19 "
50° F.	4.05 "		

Thus, if one cubic foot of air at 40° F. having a relative humidity of 75 per cent holds 1.47 grains of moisture, then

a fall of 4° F. means that saturation point has been reached, so that an optimum means that at any temperature between 32° and 40° F. no greater range than 2° is allowable. Remembering how radiation from external walls takes place, how the specific heat (0.8° F. average) of foods put in cold storage keeps raising the temperature of the chamber, and how this loss of heat of the food by conduction, radiation and evaporation tends to a saturation of the air, and therefore of condensation on its surface, it is not surprising that ice has, in a large measure, failed as a satisfactory source of cold for large storages at low temperatures.

It would appear from experiments that at least two feet in thickness of six layers of tongue and grooved boards and waterproof paper, with three hollow spaces, one filled with packed shavings of at least one foot in thickness, has proved the best practical material for constructing non-conducting walls; and that when this is thoroughly well constructed with a rapid cooling for some hours by air currents of butter, cheese, meat, etc., in an anteroom, prior to placing such in cold storage, a practical value may be given to the use of ice. The need of this cooling prior to storage is gathered from the following table:

TABLE OF SPECIFIC HEAT OF SOME FOODS.

	Water	Solids	Specific Heat Above Freezing	Latent Heat of Freezing
Lean Meat	72%	28%	0.77	102
Fat Meat	51%	49%	0.60	72
Veal	63%	37%	0.70	90
Fat Pork	39%	61%	0.51	55
Eggs	70%	30%	0.76	100
Potato	74%	26%	0.80	105
Cabbage	91%	9%	0.93	129
Cream	59%	30%	0.68	84
Chicken	73.7%	26%.	0.80	—

The necessity of this preliminary cooling is especially seen in large carcasses, since if, as the common case in packing houses, meats are subjected for through and through chilling to temperatures 10° or 15° F. below freezing, freezing of wet outer tissues would take place before the interior had been well chilled and internal anaerobic putrefactive changes might take place though surrounded by an outer casing of frozen tissues. But rapid preliminary cooling plays a yet greater part in this problem of preservation of foods. In the case of milk it is the *sine qua non*, and no subsequent care can make up for delay for even an hour in the chilling of milk to below 50° F. When rapidly chilled in clean air over ice-water pipes from 100° F. to 40° F., and then stored in sterilized bottles in cold ice storage, milk has been shown quite capable of retaining the same normal acid reaction for a whole week. As Loverdo points out, the small, watery fruits with the summer heat in them will deteriorate in a night if not rapidly chilled, which as well prevents the moisture so rapidly given off by them from causing surface condensation, and the growth of penecillum, aspergillus, etc. That this can only be attained by chilling prior to shipping in iced cars, and should be invariably carried out, has been proven by experiment and practical experience in damaged fruit, both in Europe and on this continent. Its solution has been found in the Southern States by running the fruit cars into chilling galleries with temperatures 10° to 15° below freezing, and in France by refrigerator cars fitted up with ammonia compressor refrigerating machines. Much delicacy in manipulation is in practice necessary to obtain the best results, since should fruits be subjected to a (—C.) temperature too long after losing their specific heat they would be injured by freezing. The statical condition thus established before any microbic growth has been possible, or any tissue changes have taken place, enables all foods to be thereafter handled with a degree of success, even at higher tempera-

tures, unattainable in any other way; but the same intelligent knowledge of the phenomena of air physics and the conditions favoring or retarding microbic growth is necessary to maintain the highest results. Thus, the condensation of air moisture which meat at 40° F. will cause when it is brought into a higher temperature results in a slimy surface to the meat, and forms a medium for rapid microbic growth, unless during this rising temperature the meat is kept in a free current of air.

P. H. BRYCE.

FEDERAL SUPERVISION OF BIOLOGIC THERAPEUTIC PRODUCTS

In Germany, which may be taken as a type of a paternal government, traffic in antitoxic serums is controlled by the Kgl. Institut für experimentelle Therapie, Frankfurt a. M., which is designated as the official place where, under Ehrlich's direction, all the official testing is done. Apothecaries are allowed to deal only in serums which are thus controlled. This control begins at the place of manufacture and ends with the bottling of the tested serum. The bottling is done under the supervision of a government officer known as the "Abnahmbeamte." The serum is tested for both potency and purity. Each lot, when bottled and sealed by the government officer, receives the stamp of approval of responsible authority.

This system of supervision is not possible with our dual form of government. Our Federal government can only control the manufacture and sale of biologic products when the State line is crossed; that is, a State has complete and final control over such matters so long as the antitoxin or vaccine is made and sold within the State's confines. For example, the efficient State Board of Health of Massachusetts manufactures vaccine virus and diphtheria antitoxin for use in the State of Massachusetts, and the Act of July 1, 1902, entitled "An Act to regulate the sale of viruses, serums, toxins, and analogous products in the District of Columbia, to regulate interstate traffic in said articles, and for other purposes," therefore takes no cognizance of the production and distribution of these biologic products in Massachusetts so long as the traffic is confined to that State. All persons who engage in *interstate* traffic in diphtheria antitoxin,

tetanus antitoxin or other antitoxic serums, vaccine virus, tuberculins, bacterial vaccines and similar preparations must first obtain a license from the Secretary of the Treasury through the Public Health and Marine Hospital Service to engage in this business. This license is obtained only after a thorough inspection of the laboratory and stables to insure sufficient equipment and competent *personnel* to produce safe and reliable products. All foreign manufacturers who exploit biological products in America must submit to similar inspections and obtain a similar license. The licenses are good for one year only, when the plant must be reinspected. In the meantime the products are bought on the open market and examined for purity and potency in the Hygienic Laboratory of the Public Health and Marine Hospital Service. In this way a satisfactory supervision has been maintained over biologic products in this country.

The law has been administered without fear or favor. Manufacturers have been required to expend many thousands of dollars to improve their plants in order to obtain a license in the first place, and also to use every known safeguard to protect their vaccines and antitoxins from impurities.

Perhaps the most notable effect is seen in the great change which took place in vaccine virus. Before the operation of the law the commercial vaccine virus sold in our country frequently contained bacterial impurities of a more or less serious nature; it was not unusual to find a vaccine point contaminated with many thousands of bacteria, some of them streptococci and other virulent pathogens.

Willson and McFarland* reported an epidemic of tetanus in this country in 1902 which was probably due to tetanus spores in vaccine virus. It will be remembered by many that sore arms were all too frequent as a result of vaccination before the operation of the law. The annual re-

* Journ. Am. Med. Assn., Vol. XXXVIII, 1902, p. 1147; Journ. Med. Research, n. s. Vol. II, 1902, p. 474.

ports of Surgeon-General Walter Wyman show that, as a result of the examinations made, vaccine virus sold upon the open market is now reasonably clean, containing very few bacteria and these of a harmless nature. These laboratory results are confirmed by reports of health officers, who are almost unanimous in confirming the statement that they now see few if any sore arms or any other untoward complications resulting from vaccination that may be attributed to impurities in the virus.

The unit for measuring the strength of diphtheria antitoxin is based upon that established by Ehrlich and is distributed to the licensed manufacturers. So far as the antidiphtheric serum is concerned the good effects of the law are seen in uniformity and increased potency. Before the passage of the Act there were some very weak antitoxins upon the market; now there is none having a strength of less than 250 units per cubic centimeter. Through improved methods of refinement and concentration, serums may now be obtained containing more than 1,000 units per cubic centimeter. The serums of European manufacture are decidedly weaker as compared with the American products.

The sad experience in St. Louis in 1902, reported by Bolton and Fisch,* was said to be due to the presence of tetanus toxin in the diphtheria antitoxin. Under the operations of the law every known safeguard is now utilized to prevent similar accidents, and fortunately none has since occurred.

The standardization of tetanus antitoxin has proved a difficult and it seemed for many years a hopeless task. The problem has, however, been satisfactorily solved in a practical method evolved in the Hygienic Laboratory in Washington. There are now four methods used in the standardization of tetanus antitoxin: (1) The German method according to von Behring, (2) the French method used by Roux, (3) the Italian method based upon the work of Tizzoni

* Trans. Assn. Amer. Physicians, 1902, p. 463.

and Cattani, and (4) the American method. The European methods are admitted to be cumbersome and not very accurate. The American method commends itself for simplicity and precision. A stable tetanus toxin has been found* which is issued to licensed manufacturers and others interested. The potency of an unknown serum may be tested directly against the test dose of this standard official toxin.

The work upon tetanus antitoxin has revealed the fact that the serums sold upon the open market varied extravagantly in the unit value claimed for them, and, for the most part, they had very feeble antitoxic strength. For instance, serums claimed to contain 6,000,000 units per cubic centimeter actually had but a trifling amount of antitoxic power. The antitetanic serums now on the market in the United States all have comparable strengths and sufficient potency for therapeutic use. It is noteworthy that the foreign serums are much weaker than the American serums. For instance, antitetanic serums made by the Pasteur Institute contain only about forty American units per cubic centimeter.

There is no satisfactory method of standardizing certain biologic products, such as tuberculin, antipneumococcic serum, etc. These products are, therefore, only tested for purity and freedom from contamination.

One of the gravest dangers with which manufacturers and purveyors of biologic products have to contend is the tetanus spore. In a notable article, Theobald Smith† has again called attention to some neglected facts in the biology of the tetanus bacillus. Smith shows that tetanus spores may survive a single boiling or steaming for twenty minutes regularly, usually for forty minutes, and occasionally for sixty minutes;

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*The Standardization of Tetanus Antitoxin; an American unit established under authority of the Act of July 1, 1902. By M. J. Rosenau and John F. Anderson. Bull. 44, Hyg. Lab., U.S. Pub. Health & Mar.-Hosp. Serv., Washington, 1908.

†Journ. Am. Med. Assn., Vol. L, March 21, 1908, p. 929.

in one case seventy minutes' exposure did not destroy all the spores. He also brought out the remarkable fact that culture fluids sterilized by continuous boiling or steaming in routine laboratory work, even when a relatively small amount of fluid is exposed to strong steam for twenty minutes on three successive days, is not sufficient to kill tetanus spores. Accidents with tetanus have been only too frequent. We may here refer to several outbreaks of tetanus which occurred some years ago, one in this country and one in Europe, as a result of the use of antitoxin; further, to the nineteen deaths from tetanus caused by injecting persons in Mulkowal, India, with Haffkine's plague prophylactic.

From the beginning of the government supervision of biologic products particular attention has been given to the danger from tetanus spores or tetanus toxin; in several instances licenses have been refused to manufacturers of vaccine virus on account of the proximity to horse stables. The government has insisted upon the use of the autoclave, which Smith now proves is necessary surely to kill tetanus spores. Finally, all biologic products must be tested upon susceptible animals, such as mice and guinea pigs, in order to insure the absence of tetanus before they are placed upon the market.

While the government exercises a close, constant and rigid supervision over the manufacture and interstate sale of biologic products, it does not guarantee each individual package. It holds the manufacturer responsible for the potency and purity of his products and endeavors, by inspections and laboratory examinations, to cause the manufacturer to maintain that high degree of technical excellence and conscientious and intelligent care in the preparation of these products that have proved a sufficient and reasonable safeguard.

M. J. ROSENAU.

SOME FACTORS IN THE SPREAD OF TYPHOID FEVER

Probably no disease has been more studied and more discussed than typhoid fever; yet our death rates still remain a discredit to American sanitation. Typhoid causes, year after year, in many of the most prosperous States of the Union a loss of thirty deaths per hundred thousand, three times the rate which prevails in European communities. Some of our cities which continue to drink grossly polluted water offer still more monumental examples of criminal sanitary negligence, with rates of fifty and seventy-five and a hundred.

In order to meet the typhoid problem as it is met in other countries, it is necessary to grasp it in all its aspects. We give attention to water supply at one time; we spasmodically attack the milk supply at another. Practically no community has as yet carried out a thoroughgoing and systematic campaign against typhoid fever of all sorts and from all sources.

An intelligent control of typhoid necessitates regard to three distinct factors in the spread of the disease. The prevalence of this, as of other contagious maladies, requires, first, the presence of the infective agent; second, a suitable channel for transmitting the germ to the susceptible patient; and finally, such a condition of vital resistance on the part of the patient as will permit the entrance and development of the invader. Most sanitary authorities in this country have directed their attention toward the second link in the chain, — the vehicles of disease, by which the germ passes from the sick person to the susceptible victim. Even here, however, some important factors have been strangely neglected.

Typhoid bacilli come only from infected persons. Those who exhibit active symptoms might easily be cared for; but they are not. In Germany physicians and sanitary officials enforce rigid and thorough disinfection of all excreta. Here it is too often the case that physicians are careless, and that cases of typhoid do not even come to the attention of the local officials. The first essential in the campaign is then to secure prompt reporting of cases and complete and thorough disinfection of all excreta. Furthermore, those who have been cured of typhoid may sometimes carry the bacilli in their urine for months and even years, and it should be made a part of the routine control of the disease to see that no patient is discharged from treatment until this source of danger is removed. When all is done, we shall still run a certain amount of risk from a third class of bacilli breeders, the incipient cases, some of which may be prevented by high vital resistance from ever developing into recognized cases. These are the "walking typhoids"; and in extreme instances we find bacilli carriers, like the cook now under detention by the Board of Health of the City of New York, who has apparently never suffered from the disease, but has caused half a dozen well-marked epidemics and carries typhoid bacilli habitually in her intestine. It is, of course, impossible to detect all such cases as this; and as long as they exist, supervision of the vehicles by which infection may be carried to well persons must never be relaxed. At the same time our excessive American typhoid will never be diminished unless the stream of infection is checked at the source in all cases where this can possibly be done.

Among the vehicles, or channels, by which typhoid passes from the infected person to the well person, water supply has attracted widest attention. This has justly been the case, since no other vehicle furnishes so good an opportunity for the transmission of typhoid fever to great numbers of persons at the same time. The most striking epidemics of

the past have been due to water, and the extreme death rates which still disgrace a few American cities are even now due to this cause.

Water-borne typhoid is, however, being steadily eliminated in most cities and in many States, and now accounts for only a small proportion of the total deaths from this disease. We are turning, and rightly, toward milk as a second important cause; and as long as milk is handled by a number of more or less uncleanly men and women and drunk without cooking, so long unrecognized cases of typhoid fever among milk handlers will cause epidemics. Here, as in the case of water supply, we must protect our original sources as far as possible by careful inspection as to cleanliness; and then if we are wise we shall purify the final product, — by filtration in the case of water, by pasteurization in the case of milk. Beyond these two vehicles of typhoid fever there are others to which as yet we have paid little attention. In the States where sanitary progress has been most marked, epidemics of typhoid due to water and milk combined make up a small proportion of the whole. The rest is what has been called prosodemic typhoid; that which spreads through or among the people by various channels, never reaching a large number at the same time, but passing from point to point by devious and various paths. "Food, fingers and flies," offers an illiterative explanation of much of this prosodemic typhoid. Flies no doubt cause many cases by passing from infected vaults to unprotected food. Direct contact is responsible for many more, as is shown by the cases of typhoid fever which occur even among trained nurses. How much more numerous these are among untrained attendants, only those who have studied epidemics know. The old dogma that typhoid is infectious but not contagious has slain its thousands and tens of thousands. Typhoid fever under uncleanly conditions is essentially a contagious disease; and so long as it is not treated as such, contact

infection will play its subtle and destructive part. At the bottom of all these methods of transmitting prosodemic typhoid lies the great factor of pathogenic filth. "Infected excreta getting into the mouth" is the fundamental process; and the residual typhoid due to such causes can only be met by a cleanly disposal of waste materials and by the general protection of food from pollution.

Finally there remains another factor in the transmission of typhoid, a factor almost wholly neglected, yet of much importance, the vital resistance of the patient. In every disease the infecting germ must be aided by some weakness in the defending garrison of body cells. In some of them the germ is so strong and the body relatively so weak that infection is almost always followed by the development of the disease. Such a case is found in bubonic plague. At the other extreme stand such maladies as pneumonia, where the germ is widespread and weak and the vital resistance of the patient plays a predominant part. Typhoid fever occupies an intermediate position. We know that not all who are infected develop the disease, but we know almost nothing as yet of the special factors which promote or diminish the protective powers of the body. One factor at least, however, is important, and that is temperature. The regular seasonal curve of typhoid, rising slowly to a maximum in October, is one of the most familiar phenomena of this disease. "Fall fever," it was called by Dr. Elisha Bartlett in the old days. Where heavily polluted water causes epidemics in the autumn and spring this regularity is broken, but in other cases the normal typhoid curve is a direct function of the temperature. A part of the autumn maximum may be due to the special opportunities for infection which beset vacations under unsanitary surroundings, and the excessive prevalence of flies at this season doubtless plays its part. The phenomenon is however far too general to be accounted for by local factors. It used to be thought that the relation was mainly

due to a favorable effect of warmth upon the germs in the environment, more surviving in hot weather than in cold. Recent studies have indicated, however, that temperature may perhaps act directly on the patient too. In a careful investigation of typhoid fever at Washington, it appeared that the summer rise reached its maximum, after a short period of extreme hot weather, much more rapidly than could be accounted for by any gradual increase in the proportion of germs in the environment. Recently studies of typhoid in India have shown that the maximum prevalence among the white troops is in the hot season as with us, while among the natives the maximum occurs during the cold and rainy months. This seems conclusive proof that the organism of the host is affected by abnormal and inclement seasons. We do not yet know enough of the qualities that make for vital resistance to be able to control them in diminishing typhoid fever; but the relation of the disease to temperature furnishes a useful pointer for research. Improper feeding, abnormal physical exercise and other hygienic factors which accentuate the effects of hot weather may play their part as predisposing causes. If physicians, with the opportunity of observing epidemics in detail, can throw light upon these contributory causes, we may have a new arsenal of weapons for the campaign.

The effect of high temperature in favoring the attack of the typhoid invader helps to explain some of the most notable facts in the geographical distribution of the disease. A direct effect upon the vital resistance of the host makes comprehensible that regular increase in the prevalence of typhoid fever which is noticed as we pass southward along the Atlantic seaboard. Summer heat may offer one reason for the prevalence of this disease in the United States as a whole, in comparison with parts of Europe which show a more even climate. Most of our excess of residual typhoid, however, could be prevented by intelligent and

efficient health administration. Ten thousand lives a year may be saved by the sanitary authorities of the United States when they awake to their obligations in regard to the disinfection of infected excreta; the cleanly disposal of waste materials in general; and the protection of water, milk and other food supplies from filth.

C.-E. A. WINSLOW.

SPECIAL ARTICLES

NOTES ON THE USE OF SMITH SOLUTION AND BILE MEDIA*

By L. V. PARKER
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In the spring of 1907 the question of the relative efficiency of Smith and bile media, used as a purely presumptive test in the detection of *B. coli*, was brought up by the engineer in charge of the investigation of the water purification plants of the State of Ohio. A preliminary study of the relative value of the two media at Youngstown indicated that the bile was a more delicate and reliable test. In order to ascertain whether this would hold true in other cases, the laboratory procedure in carrying out *B. coli* determinations was modified so as to include bile media. The general procedure in carrying on these studies was to run parallel examinations on all samples, using both Smith and bile media for a preliminary growth and carrying these samples through a series of confirmatory tests.

MEDIA USED. Fresh ox bile was used which was first sterilized in the autoclave at about eight pounds pressure. After this preliminary sterilization, one and one-half per cent of lactose was added. The media was tubed and sterilized in streaming steam on three successive days. Other media was prepared in accordance with the "Standard Methods" recommended by the Laboratory Section of the American Public Health Association, except that in the case of the

* Received for publication March, 1908.

50 and 100 c.c. portion mentioned in the paper, a dextrose broth containing sufficient phenol to give a final dilution of .025 per cent was used for enrichment.

The procedure recommended by the Committee on Standard Methods of the Laboratory Section of the American Public Health Association was used, except that in some cases the tests for motility and morphology were omitted. The complete procedure was carried out on two hundred samples and the following results were obtained. The total number of samples giving positive *B. coli* findings, using results from both media, were: in the 1 c.c. portion, 109; in the 50 c.c. portion, 86; in the 100 c.c. portion, 82.

SUMMARY OF RESULTS FROM THE EXAMINATION OF TWO HUNDRED SAMPLES

	Smith						Bile					
	Presumptive			Confirmatory			Presumptive			Confirmatory		
C.c. of sample	1	50	100	1	50	100	1	50	100	1	50	100
Positive findings	108	94	84	81	82	66	116	88	82	105	84	79
Percentage confirmed	....	....	....	75	87	79	....	....	....	91	95	96

When the results shown in the table are compared, it will be seen that the bile, used as a purely presumptive test, is much more satisfactory than the dextrose broth. And if the further comparison is made, using the positive findings from both media, as given in the figures preceding the table, the efficiency of the bile used as a presumptive test, compared with the complete procedure, is very high.

HIGH AND LOW COUNTS. In order that the influence of high and low counts on the *B. coli* findings might be ascertained, a certain number of such results were tabulated. The counts were made on 1½ per cent agar plates, incubated at room temperature for either two or three days, depending upon the season. The results are as follows:

SUMMARY OF RESULTS FROM TWENTY-FIVE SAMPLES GIVING A COUNT ABOVE FIVE THOUSAND

	Smith						Bile					
	Presumptive			Confirmatory			Presumptive			Confirmatory		
C.c. of sample	1	50	100	1	50	100	1	50	100	1	50	100
Positive findings	17	15	7	8	11	5	13	13	6	9	10	6
Percentage confirmed	....	....	....	47	73	71	....	....	....	69	77	100

Using the results obtained from both media, 9 positive final findings were obtained in 1 c.c., 11 in 50 c.c., and 8 in 100 c.c.

SUMMARY OF RESULTS FROM TWENTY-FIVE SAMPLES GIVING A COUNT BELOW THREE HUNDRED

	Smith						Bile					
	Presumptive			Confirmatory			Presumptive			Confirmatory		
C.c. of sample	1	50	100	1	50	100	1	50	100	1	50	100
Positive findings	8	4	19	2	2	8	4	2	11	3	2	9
Percentage confirmed	....	....	....	25	50	42	....	....	....	75	100	82

Using the results obtained from both media, 4 samples gave a final positive finding in 1 c.c., 2 in 50 c.c., and 10 in 100 c.c.

The summary of the samples giving counts above 5,000 indicates that in both media gas formation may be noted and subsequent tests prove the absence of *coli*. The relative efficiency of the bile medium, however, appears higher in this direction, while, on the other hand, very few really positive findings are lost. The results obtained in the case of low counts are very similar to those shown by the counts above 5,000 per c.c., except that an even higher efficiency is shown for the bile medium.

GENERAL SUMMARY. During the time covered by the investigation, 704 samples from various sources were

examined. The complete procedure was carried out on 200 of these with the results previously mentioned.

Of the other 504 samples, none gave 25 per cent gas in the bile tube, 66 gave gas in the Smith tube and all of them failed to give characteristic red colonies on the lactose azolitmin agar plate or were negative in a majority of the subsequent tests. Therefore, while the comparative efficiency of the two media in detecting true positive cases is well indicated, the relative efficiency of the bile in cutting out negative cases is apparently much underrated.

The foregoing data was obtained from a review of the notes of the routine work of the laboratory. The results indicate a much higher efficiency for the bile media than for the Smith solution and, also, that presumptive tests with bile media are, compared with the routine method practised in this laboratory, remarkably efficient.

The limited scope of the experiments prevents the giving of more definite statements.

American Public Health Association

LABORATORY SECTION

A METHOD FOR CALCULATING THE NUMBERS OF B. COLI FROM THE RESULTS OF DILUTION TESTS*

By EARLE B. PHELPS, S.B.
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Two general methods are available for the preliminary isolation of *B. coli*. The sample may be plated out on a lactose litmus medium and the red colonies counted and fished; or a series of dilutions may be made in a liquid sugar medium, the resulting production or non-production of gas noted, and suitable plates made from the highest dilution giving a positive test. The plate method has the advantage of simple manipulation and of yielding quantitative results. The dilution method, on the other hand, possesses the greater sensitiveness associated with liquid media, but, unless a very large number of dilutions be made, its results are only roughly quantitative. Such results are not suitable for the direct calculation of averages in routine work, nor can they be used directly in purification studies for the determination of "per cent removed."

The nearest approach to any quantitative statement is the one frequently used under such a heading as "per cent of positive tests in 1 c.c."; that is, it is tacitly assumed that, if 25 per cent of the 1 c.c. samples give positive tests, the

* Read before the Laboratory Section, American Public Health Association, at Atlantic City, Sept. 30, 1907.

organism is present once in every 4 cubic centimeters. The mathematics of this reasoning is strictly correct only if the water in question contains absolutely the same numbers day after day, and the results obtained vary from the actual facts more and more the greater the daily fluctuation in numbers. The truth of this statement will become apparent if a hypothetical case be worked out.

With waters that vary greatly from day to day in their *B. coli* content, or with sewages and sewage effluents, a more accurate procedure consists in making such a series of dilution on each sample that both positive and negative tests will be obtained. For example, with a sewage effluent containing, let us say, 1,000 *B. coli* per c.c., dilutions of .01, .001 and .0001 c.c. would generally give two positive and one negative test, although the middle dilution might by chance be negative. There is also one chance in ten of the highest dilution giving a positive test. The actual chance of a negative test on the middle dilution could be determined mathematically by Maxwell's distribution law, but in a case of this kind the chance of an even distribution of the bacteria is sufficiently great to be considered unity for practical purposes.

It is the purpose of the present paper to show that from a series of results obtained in this way, on a water whose bacterial content is varying from day to day, a fairly accurate statement of the average numbers present can be calculated. The accuracy of the result will depend largely upon the number of observations averaged and to a lesser degree upon the uniformity in the actual numbers present from day to day.

The principle upon which this method of calculation is based is this: If a series of dilutions are made from a given water and these dilutions submitted to appropriate tests giving positive or negative results, the most probable value of the actual numbers of organisms present is indicated by

the reciprocal of the greatest dilution giving a positive test. For example, if dilutions of 0.1, .01 and .001 c.c. are investigated and a positive result obtained on the first two and not on the last, the most probable number of bacteria present in the water is 100. From this one test alone it might be inferred that such was not the case. It would ordinarily be stated that the number present was over 100 and under 1,000, with a probable value, perhaps, of 550. Such a statement would overlook the possibility of its being but 50, a one to one chance, or but 10, a one in ten chance. However, the accuracy of any statement based upon this one test would be but slight. Suppose now we have ten such tests with identical results. The ten .001 c.c. portions make one .01 c.c., so we have ten .01 c.c. tests positive and one negative. This practically eliminates the possibility of there being over 100 organisms present per cubic centimeter. If there were more than 100 present the chance of its being absent in .01 c.c. would be very slight, while it would have been found once at least in ten .001 c.c. portion. On the other hand, if samples present were far below 100, consistent positive tests would not have been obtained in .01 c.c.

If, therefore, we write down the reciprocal of the highest dilution giving a positive test as the number of organisms present in a given sample, we shall have selected the most probable value. This merely means that in any single test the value taken may be widely in error, but that the average of 50 or 100 tests will not be far from the truth.

The truth of these statements may best be shown by an example.

Let us assume that during one hundred days a sewage filter effluent was under examination, samples being taken daily and tested in dilution of from .1 to .00001 c.c. We will further assume that on certain ten of these days there were 10 *B. coli* present, on ten other days, 50, and so forth up to 90,000, as shown in the accompanying table. The table then

shows how many positive tests would be obtained at each dilution out of each set of ten made on a sample of a given kind.

B. Coli Actually Present on Each of Ten Days	Number of Positive Tests at Each Dilution Out of a Set of Ten Daily Tests				
	0.1	0.01	0.001	0.0001	0.00001
10	10	1	0	0	0
50	10	5	0	0	0
90	10	9	0	0	0
400	10	10	4	0	0
800	10	10	8	0	0
1,200	10	10	10	1	0
2,000	10	10	10	2	0
9,000	10	10	10	9	0
50,000	10	10	10	10	5
90,000	10	10	10	10	9
153,550	100	85	62	32	14
	15	23	30	18	14

Adding up the columns, we get the total number of positive tests at each dilution and also the number of *B. coli* which, divided by 10, gives the average number for the 100 days. This average is seen to be 15,000 in round numbers. Subtracting the total positive tests at each dilution from the total at the next lower dilution gives the number of times that each test was the highest positive dilution in its set. We see that the 0.1 c.c. was the highest dilution giving the test 15 times, .01 c.c., 23 times, etc. Multiplying these numbers by the reciprocal of the dilution, adding and dividing by the total number of tests, 100, we get the average number 16,000 against the true average, 15,000, thus:

$$\begin{array}{r} 150 \\ 2{,}300 \\ 30{,}000 \\ 180{,}000 \\ 1{,}400{,}000 \\ \hline 1{,}612{,}450 \div 100 = 16{,}000 \end{array}$$

An unusually wide range of values has been taken to show that the method of treatment proposed will give accurate

results even under such severe conditions. Obviously the lower numbers have little effect upon the average. With more uniform figures accurate results are obtained with fewer tests. Thus taking the 50 days with the lower values, 10 to 800, we find the actual average to be 270, calculated 290. Similarly, for the remaining 50 days, the actual average is 30,000, calculated 32,000.

The method is obviously of no value for single tests and finds its most useful application in routine studies in water and sewage purification when it is desirable to determine average numbers over a month or a year in order to calculate the efficiency of the process.

To avoid the use of long decimal numbers for dilution, we may use the logarithm of their reciprocals. Thus a dilution of 0.1 would be 1; 0.01, 2; 0.001, 3, etc. These numbers have an additional meaning. They show the number of zeros to be added to 1, or to any plate count, to get the actual numbers. Thus, for a test positive in dilution 2 and negative dilution 3, we write 100; or, if it were positive in dilution 3, 1,000. Similarly for a plate count, if we get 85 colonies on a plate marked 2, we write 8,500, or, if the number was 3, 85,000. Furthermore, in making the dilution originally, the use of these numbers greatly reduced the chance of error. Each dilution of 1 to 10 increases the factor by 1; from 1 to 100, by 2.

With the use of these dilution factors the operation of the rule which has here been described is very simple. For each daily test we write down 1, followed by as many zeros as are indicated by the dilution factor of the highest positive test. These numbers do not necessarily show the actual number present in the sample tested, but monthly averages made from them are fully as accurate as any other bacterial count. The only precaution to be observed is that in each test the range of dilution shall be so great that at least one positive and one negative test shall be obtained.

NORMAL WATERS OF ILLINOIS*

By EDWARD BARTOW

The State of Illinois, extending, as it does, three hundred and seventy-eight miles from north to south and two hundred and seven miles from east to west, presents a varied geological character. There is a dip in the geological strata from north to south, and glacial drift covers more than two-thirds of the State. These features influence the character of the water, causing great variations.

In determining the normal waters, the following divisions, suggested by Professor A. W. Palmer, may be made:

1. Surface waters, including rivers, lakes and ponds.
2. Springs.
3. Shallow wells.
4. Deep wells in drift.
5. Deep wells in rock.

Observations of the municipal water supplies show the distribution of these classes of water throughout the State. These are indicated on the map. Deep rock wells are used most commonly for water supplies in the portion of the State north of a line drawn from Quincy to Chicago. The deep drift wells are used most commonly in the territory bounded on the north by the above-mentioned line, and on the south by a line drawn from Danville to the Mississippi River, just below St. Louis. South of the second line the great

* Abstract of paper read before the Laboratory Section, American Public Health Association, at Atlantic City, Sept. 30, 1907.

majority of the cities obtain their water supplies from rivers or reservoirs.

A study of the mineral content of the deep rock wells shows that the amount of mineral matter in the water increases from north to south, reaching its maximum in the wells along the line drawn from Quincy to Chicago. South of this line the deep rock wells, reaching down into the St. Peter's and Potsdam sandstone, contain so much mineral matter that they are useless as sources of water supply. A few of the deep rock wells to the south in other strata furnish satisfactory water. The variation in the usual sanitary chemical data obtained by analyzing these deep rock well waters is so great that the normals can be determined only by careful study of waters from many wells, and by classification according to the strata from which the waters come.

The variations are nicely illustrated in the table of analyses of water from deep rock wells. The table shows analyses of water from three wells in the northern portion of the State, and of one good water (Belleville), and one water with high mineral content (Lawrenceville) from the southern portion of the State.

ANALYSES OF WATER FROM WELLS OVER FIVE HUNDRED FEET DEEP IN ROCK

Laboratory No.	13785	15603	15753	15687	15503
Town	Elgin	Marseilles	Streator	Belleville	Lawrenceville
County	Kane	La Salle	La Salle	St. Clair	Lawrence
Depth	2,000 ft.	600 ft.	1,115 ft.	1,500 ft.	1,710 ft.
Turbidity	20.	Clear	Very slight	Clear	Very decided
Color	1.0	.2	0	.2	Brown
Odor	0	0	0	0	Kerosene
Residue on evaporation	376.	464.	2,415.	401.	29,108.
Chlorine	3.5	61.	1,000.	16.	17,400.
Consumed oxygen	4.0	2.25	8.45	1.75	46.3
Nitrogen as free ammonia	1.08	.080	1.280	.008	3.44
Nitrogen as albuminoid ammonia	.192	.032	.016	.048	.056
Nitrogen as nitrites	.000	.004	.250	.008	.000
Nitrogen as nitrates	.24	.400	.070	.752	.280
Alkalinity	323.	297.	273.2	297.	407.9
Bacteria per c.c.	0	0	95.	50+.	730.
Colon bacillus in 1 c.c.	Absent	Absent	Absent	Absent	.....

Wells in the drift are also variable. This is especially noticeable with respect to oxygen consumed, and free or saline ammonia. The excessive free ammonia in these drift wells cannot indicate recent pollution, as it is not accompanied by an excessive number of bacteria nor by the colon bacillus. The waters from the glacial drift usually become turbid on exposure to the air, and should be aerated or otherwise treated before they are allowed to enter the mains. An investigation of their properties becomes, therefore, a study of their inorganic content. According to their inorganic content, these drift waters, and the other waters also, can be divided into two classes, as there is, or is not, more than enough sodium present to combine with all the nitrate, chlorine and sulphate ions. Those containing an excess of sodium ions may be successfully treated with lime. Those which do not contain an excess of sodium can be more satisfactorily treated by the addition of sodium carbonate or hydrate with the lime.

The streams which are practically all sulphate waters are now normally impure, and should at least be filtered before being used for water supplies. An investigation of their properties becomes also a study of their inorganic content, together with the suspended matter. Examinations of Illinois rivers at twenty-seven stations show a higher turbidity in the rivers to the south. The Kankakee River, rising in swamps in northern Indiana, is least turbid, but has the highest sulphates. The chlorine in all cases varies somewhat with the season, but the general averages do not differ materially.

To summarize, in deep rock wells we find great variation in mineral content. In the northern part of the State, where most of them are found, this mineral content increases from north to south. The deep drift waters are so variable that the usual sanitary tests for free ammonia and consumed oxygen have little value. The streams are all more or less

turbid, the turbidity being more persistent to the south, and all the streams must be treated by filtration or sedimentation before they can be used for drinking purposes.

Finally, from the data now at hand, the conclusion must be drawn, that not only no general normal can be established for the State, but also that no general normal can be established for each class of waters.

THE ANTISEPTIC AND GERMICIDAL PROPERTIES OF SOLUTIONS OF FORMALDEHYDE AND THEIR ACTION UPON TOXINS *

By JOHN F. ANDERSON

From Hygienic Laboratory, Public Health and Marine-Hospital Service

Since the discovery by Loew and Fischer, in 1886, of the germicidal action of formic aldehyde a large amount of work has been done with the substance both as a gas evolved by various means and in the watery solution.

The recent work by McClintic seems to have established its limitations when used as a gas. The great variation in the results of various workers in regard to its action as a germicide and antiseptic in its watery solution has led me to try to determine its real value. The need of an efficient and, at the same time, a safe and comparatively cheap disinfectant is great, especially for the disinfection of the excreta of persons sick with infectious diseases. For this purpose the agent should be rapid in its action, an efficient deodorant, comparatively cheap and safe to handle. Formic aldehyde in solution, in my opinion, comes nearer to fulfilling these conditions than any other agent we have at the present time.

In the minds of the laity a deodorant is more or less synonymous with a germicide, but, of course, a deodorant may be almost valueless as a disinfectant, and, on the other

* Abstract of paper read before the Laboratory Section, American Public Health Association, at Atlantic City, September 30, 1907.

hand, a disinfectant may possess but slight deodorizing properties. In the use of an agent for the disinfection of excreta, etc., it is important that the person using it understands just what is meant when told to disinfect the discharge with a five per cent solution. It may be understood that a five per cent solution of the agent is to be added to the discharge, while what is really meant is that the agent shall be in the proportion of 5 parts in 100 of the total volume under treatment. Of course it is needless to say that there must be a thorough mixture of the agent and of the material to be disinfected, and that they must remain in contact a sufficient length of time for the maximum action of the germicide to be exerted. While, for example, a 2 per cent solution might kill typhoid bacilli in 30 minutes, it might take a 1 per cent solution an hour or longer.

A number of samples of different solutions of formic aldehyde were analyzed to determine the exact percentage of the aldehyde contained therein, and quite a variation in the percentage was noted. The highest was 52 per cent, which was in a sample sent by a manufacturer, but it soon decreased to 43; the lowest was 29 per cent.

Bernard Smith examined 29 samples, and the lowest percentage he found was 32.45 per cent and the highest 39.11 per cent, the average of the 29 samples being approximately 37 per cent. My work was done with solutions varying from 37.2 per cent to 37.4 per cent, and will be discussed in percentages of formalin, the name by which the watery solution is best known, of about 37.2 per cent formic aldehyde.

ORIGINAL WORK

ANTISEPTIC POWER OF FORMALIN. A series of experiments was made to determine the amount of formalin

necessary to restrain the development of bacteria and molds in stable manure, garden earth, etc. For this purpose nutrient broth was placed in sterile flasks and formalin added in proportions of 1 to 7,000 down to 1 to 500. The broth was then inoculated with the various materials, kept at room temperature, and observed for fourteen days.

It was found that in the flask to which garden earth was added that bacterial growth ceased in the dilution of 1 to 5,000, and mold developed on the seventh day in the dilution of 1 to 1,000.

In the flask to which stable manure was added bacterial growth occurred in the dilution of 1 to 4,000, and mold on the seventh day in 1 to 1,000.

In the flask to which were added bits of hay bacterial growths occurred in a dilution of 1 to 4,000, and mold on the fourth day in a dilution of 1 to 1,000.

It will be seen that the lowest dilution in which bacterial growth occurred was 1 to 4,000, and molds in 1 to 1,000.

ANTISEPTIC POWER AGAINST PURE CULTURES. The above experiment having been made to determine its restraining influence for putrefactive changes, another series was made to determine its antiseptic action against pure cultures of bacteria.

For this purpose bouillon containing various proportions of formalin was distributed in sterile test tubes and each tube was then inoculated with a small loopful of a 48-hour agar culture of the particular organism, placed in the incubator at 37 degrees C., and observed daily for 15 days. The formalin used contained 37.2 per cent formic aldehyde.

The results are shown in the following table:

TABLE I.

SUMMARY SHOWING LOWEST DILUTION IN WHICH ALL GROWTH WAS RESTRAINED

ORGANISM	Dilution in which All Growth Was Restrained
Staphylococcus epidermidis albus	1 to 4,000
Staphylococcus pyogenes albus	1 to 3,000
Staphylococcus pyogenes aureus	1 to 3,000
Staphylococcus pyogenes citreus	1 to 3,000
Bacillus typhosus	1 to 3,000
Bacillus coli communis	1 to 3,000
Bacillus dysenteriæ (Shiga)	1 to 4,000
Bacillus pyocyaneus	1 to 3,000
Bacillus choleræ	1 to 6,000
Bacillus diphtheriæ	1 to 5,000
Bacillus mallei	1 to 6,000
Bacillus anthracis	1 to 4,000
Bacillus pestis	1 to 5,000
Bacillus megatherium	1 to 6,000
Bacillus subtilis	1 to 3,000
Bacillus prodigiosus	1 to 3,000
Bacillus acidi lactici	1 to 6,000
Bacillus proteus	1 to 6,000
Bacillus enteritidis	1 to 3,000

From the above it will be seen that many of the organisms used grew in dilutions as low as 1 to 4,000; a few were restrained in a dilution of 1 to 6,000; none grew in a stronger solution than 1 to 3,000.

GERMICIDAL POWER OF FORMALIN. The germicidal power of formalin in various strengths was studied on pure cultures, human fæces and sputum. The growth in broth tubes was principally used. Agar plates were also made at corresponding intervals in order to determine when the maximum effect of formalin is exerted.

GERMICIDAL POWER AGAINST PURE CULTURE. The germicidal power of formalin was determined in 1, 2, 3, 5 and 10 per cent dilutions against the principal pathogenic

organisms. The following method was observed in each case: For a 5 per cent strength 94 c.c. of sterile water was placed in a sterile flask and 1 c.c. of a heavy emulsion freed from clumps, of a 48-hour slant agar culture of the organism being studied, was added; then 5 c.c. of formalin was added to the entire contents of the flask and well shaken. One loopful at 10-minute intervals up to one hour was planted in a full tube of nutrient bouillon and the growth noted from day to day.

The experiments were repeated in each dilution so as to check any irregularities that might occur.

The results of the experiments, summarized, show that 1 per cent formalin containing 37.2 per cent aldehyde killed the vibrio of cholera in 10 minutes, *B. coli* in 90 minutes, *B. diphtheriæ* in 20 minutes, *B. mallei* in 10 minutes, *B. pyocyaneus* in 40 minutes, *B. dysenteriæ* and *Staphylococcus albus* grew up to 2 hours, and *Staphylococcus pyogenes aureus* and *B. typhosus* were killed in 90 minutes.

Two per cent formalin (containing 37.2 per cent aldehyde) killed *B. coli* after 60 minutes' exposure, *B. diphtheriæ* after 10 minutes, *B. pyocyaneus*, 10 minutes, *B. dysenteriæ*, 60 minutes, *Staphylococcus pyogenes albus*, 60 minutes, and *Staphylococcus pyogenes aureus* and *B. typhosus* after 40 minutes.

Three per cent formalin (containing 37.2 per cent aldehyde) killed *B. coli* after 30 minutes' exposure, *B. dysenteriæ*, 40 minutes, *Staphylococcus pyogenes albus*, 30 minutes, *Staphylococcus pyogenes aureus*, 20 minutes, and *B. typhosus* after 20 minutes.

Five per cent formalin (containing 37.2 per cent aldehyde) killed *B. coli* and *Staphylococcus pyogenes albus* after 30 minutes' exposure, *B. dysenteriæ* after 40 minutes, *Staphylococcus pyogenes aureus* and *B. typhosus* after 20 minutes.

Ten per cent formalin (containing 37.2 per cent aldehyde) killed all the non-spore-bearing organisms tested in less than

10 minutes, except *B. dysenteriæ* and *Staphylococcus pyogenes aureus*, which were killed after 10 minutes.

TIME OF MAXIMUM GERMICIDAL EFFECT. In order to study when the greatest germicidal action is exerted, pure cultures of the five most resistant organisms were exposed to a 2 per cent and a 3 per cent solution of formalin. The dilutions were made just as in the preceding experiments, but instead of making plants in broth a loopful of the exposed culture was put into a full tube of melted agar and then poured into a petri dish which, as soon as the agar had hardened, was placed in the incubator.

The colonies were counted on the fourth day. Plants were made at 5-minute intervals, except in the case of *B. pyocyaneus*, when exposed to 3 per cent formalin, and then plants were made at 2-minute intervals.

It was found that with a two per cent solution of formaldehyde the maximum germicidal effect was exerted in the first five minutes.

With a three per cent solution this immediate effect is more apparent, and in the case of *B. pyocyaneus* the great mass of organisms is killed in the first two minutes.

ACTION ON FÆCES. Its germicidal action having been determined against pure cultures, experiments were done to determine its value as a disinfectant of human excreta.

Human fæces with urine added were thoroughly mixed with sufficient water so that there should remain no large clumps. A watery suspension from a number of 48-hour agar slants of *B. pyocyaneus* was added to the mixture and well mixed in, this being done on account of the green color it shows in culture, which was used as an index of the destruction of the non-spore-bearing organisms. To an accurately measured quantity of this mixture sufficient formalin was added so as to give a 3 per cent, 5 per cent or 10 per cent

dilution by volume of formalin. Plants were made into broth tubes and agar, which latter were at once poured into petri dishes. The growth in the broth tubes was observed for ten days; the colonies on the plates were counted on the fourth day.

A 3 per cent solution destroys a great majority of the non-spore-bearing organisms in fæces in the first 10 minutes, a few, however, resisting a somewhat longer exposure; the spore-bearing organisms grew up to 120 minutes.

Five per cent formalin acting upon fæces destoyed most of the non-spore-bearing organisms within 10 minutes; a few resisted 40 minutes. The spore-bearing organisms resisted as long as 60 minutes.

Fæces exposed to 10 per cent formalin solution were rendered practically sterile immediately; a few colonies developed in 10 minutes. The spore-bearing organisms were destroyed after 40 minutes.

A 10 per cent solution of formalin completely deodorized fæces at once. A 3 and 5 per cent solution rendered them almost odorless after a very few minutes' exposure.

On account of its germicidal efficiency and deodorant action formalin would seem to be one of the most useful agents for the disinfection of infected human discharges when used in a 10 per cent dilution, allowing an exposure of one hour after thorough mixing.

DISINFECTION OF SPUTUM. In order to determine the efficiency of formalin for the destruction of tubercle bacilli in sputum, the following experiment was done:

Ten cubic centimeters of sputum from an advanced case of pulmonary tuberculosis were added to 180 cubic centimeters of sterile water and the mass of sputum broken up as much as possible. An amount of the mixture of sputum and water equal to that used to inoculate the guinea pigs after exposure to formalin was given to a guinea pig as a

control. Sufficient formalin was added to the sputum to make a 5 per cent solution by volume. At intervals of 15 minutes up to 1 hour a small amount was given to a guinea pig intraperitoneally with the following result:

TABLE II.

TIME	DEATH IN	POST MORTEM FINDINGS
15 minutes.	71 days	Generalized tuberculosis.
30 " .	31 "	Generalized tuberculosis.
45 " .	72 "	Generalized tuberculosis.
60 " .	Killed 5 months later	No indication of tuberculosis; had gained in weight.

The control pig died in 35 days with lesion of generalized tuberculosis.

The experiment was repeated with another specimen of sputum with practically the same result.

It would seem, from the above, that 5 per cent formalin in one hour was sufficient to render tuberculous sputum harmless.

ACTION OF FORMALIN ON TETANUS AND DIPHTHERIA TOXINS. Aronson called attention to the fact that formalin in the proportion of 1 to 500 added to diphtheria toxin was sufficient to protect a guinea pig against 100 fatal doses of the toxin.

Burckhard found that formalin, when added to tetanus toxin in the proportion of 1 to 250, was sufficient to protect a mouse against a dose of tetanus toxin that caused the death of the control in twenty-four hours. Burckhard does not seem to have determined the fatal dose of his tetanus toxin.

Neither of them states how long the formalin was left in contact with the toxin before it was injected into the animal.

My work on the action of formalin was all tested on guinea pigs and the MLD of the toxins accurately determined.

Pure tetanus and diphtheria toxins, of which the MLD had been accurately determined, were exposed to various percentages of formalin for varying lengths of time. It was found that when tetanus toxin is exposed to 5 per cent formalin for six hours, a guinea pig is able to withstand 100 MLD of this formalinized toxin; that 3 per cent formalin after twenty-four hours' exposure protects against the toxin; that 3 per cent formalin, after one hour, destroys a part of the toxin, and that its action increases with the length of exposure.

Diphtheria toxin is more susceptible than tetanus toxin, as 4 per cent formalin, after six hours' exposure, protects a guinea pig against acute death, paralysis, however, not being prevented. One per cent, after twenty-four hours' exposure, has the same effect. Its action against the toxin increases with the length of exposure.

This action of formalin on toxin is an important property in its use as a disinfectant, for not only are the bacteria themselves destroyed, but their soluble products as well.

Attempts have been made to treat certain septicemic conditions by means of the intravenous injection of weak formalin solutions, but without much success. Perhaps more success would attend its use in localized infections where there is a nest of germs elaborating a toxin, which is absorbed and distributed throughout the system. This phase of the subject, it is hoped, will be treated in a later paper.

SUMMARY AND CONCLUSIONS. Formalin in the proportion of 1 to 5,000 was sufficient to restrain all bacterial growth in bouillon contaminated with garden earth. Molds developed in a dilution of 1 to 1,000.

In a dilution of 1 to 4,000 formalin restrains bacterial growth in bouillon contaminated with stable manure.

A dilution of 1 to 4,000 restrains bacterial growth in bouillon contaminated with wisps of hay. Molds developed in a dilution of 1 to 1,000.

A dilution of 1 to 3,000 restrained all bacterial growth in pure cultures of thirteen different organisms. Some were restrained in a dilution of 1 to 4,000 and a few in a dilution of 1 to 6,000.

One per cent formalin, containing 37.2 per cent aldehyde, killed the vibrio of cholera in 10 minutes, *B. coli* in 90 minutes, *B. diphtheriæ* in 20 minutes, *B. mallei* in 10 minutes, *B. pyocyaneus* in 40 minutes, *B. dysenteriæ* and *Staphylococcus albus* grew up to 2 hours, and *Staphylococcus pyogenes aureus* and *B. typhosus* were killed in 90 minutes.

Two per cent formalin (containing 37.2 per cent aldehyde) killed *B. coli* after 60 minutes' exposure, *B. diphtheriæ* after 10 minutes, *B. pyocyaneus*, 10 minutes, *B. dysenteriæ*, 60 minutes, *Staphylococcus pyogenes albus*, 60 minutes, and *Staphylococcus pyogenes aureus* and *B. typhosus* after 40 minutes.

Three per cent formalin (containing 37.2 per cent aldehyde) killed *B. coli* after 30 minutes' exposure, *B. dysenteriæ*, 40 minutes, *Staphylococcus pyogenes albus*, 30 minutes, *Staphylococcus pyogenes aureus*, 20 minutes, and *B. typhosus* after 20 minutes.

Five per cent formalin (containing 37.2 per cent aldehyde) killed *B. coli* and *Staphylococcus pyogenes albus* after 30 minutes' exposure, *B. dysenteriæ* after 40 minutes, *Staphylococcus pyogenes aureus* and *B. typhosus* after 20 minutes.

Ten per cent formalin (containing 37.2 per cent aldehyde) killed all the non-spore-bearing organisms tested in less than 10 minutes, except *B. dysenteriæ* and *Staphylococcus pyogenes aureus*, which were killed after 10 minutes.

With a 2 per cent solution of formaldehyde the maximum germicidal effect was exerted in the first 5 minutes.

With a 3 per cent solution this immediate effect is more

apparent, and in the case of *B. pyocyaneus* the great mass of organisms is killed in the first two minutes.

A 3 per cent solution destroys a great majority of the non-spore-bearing organisms in fæces in the first 10 minutes, a few, however, resisting a somewhat longer exposure; the spore-bearing organisms grew up to 120 minutes.

Five per cent formalin, acting upon fæces, destroyed most of the non-spore-bearing organisms within 10 minutes; a few resisted 40 minutes; the spore-bearing organisms resisted as long as 60 minutes.

Fæces exposed to 10 per cent formalin solution were rendered practically sterile immediately; a few colonies developed in 10 minutes. The spore-bearing organisms were destroyed after 40 minutes.

A 10 per cent solution of formalin completely deodorized fæces at once. A 3 and 5 per cent solution renders them almost odorless after a very few minutes' exposure.

On account of its germicidal efficiency and deodorant action formalin would seem to be one of the most useful agents for the disinfection of infected human discharges when used in a 10 per cent dilution, allowing an exposure of one hour after thorough mixing.

Bacilli in tuberculous sputum were killed after an exposure to 5 per cent formalin for 60 minutes. Sputum exposed for 15, 30 and 45 minutes respectively still contained live tubercle bacilli.

When tetanus toxin is exposed to 5 per cent formalin for 6 hours a guinea pig is able to withstand 100 MLD of this formalinized toxin. Three per cent formalin, after 24 hours' exposure, protects against the toxin; it destroys a part of the toxin in 1 hour, its action increasing with the length of exposure.

Diphtheria toxin is more susceptible than tetanus toxin, as 4 per cent formalin, after 6 hours' exposure, protects a guinea pig against acute death; paralysis, however, is not

prevented. One per cent, after 24 hours' exposure, has the same effect. Its action against the toxin increases with the length of exposure.

This action of formalin on toxin is an important property in its use as a disinfectant, for not only are the bacteria themselves destroyed, but their soluble products as well.

For details of experiments and full discussion of the literature, see "The Antiseptic and Germicidal Properties of Solutions of Formaldehyde and their Action upon Toxines," by John F. Anderson. Hygienic Laboratory Bulletin No. 39, U.S. Pub. Health & Mar.-Hosp. Serv., Washington, 1907, 48 p. 8vo.

THE SPECIFIC NATURE OF ANAPHYLAXIS*†

By M. J. ROSENAU and JOHN F. ANDERSON

From Hygienic Laboratory, Public Health and Marine-Hospital Service

From our first studies upon hypersusceptibility we were interested in the question, "Is this reaction specific?"

In our work upon the toxic action of horse serum‡ we showed that this reaction is quantitatively specific for serums; that is, guinea pigs sensitized with horse serum are subsequently very susceptible to a second injection of horse serum, but only slightly if at all susceptible to a second injection of the serum of other animals, such as rabbit, cat, dog, hog, sheep, chicken or man. Conversely, guinea pigs sensitized with the serum of these other animals are not very sensitive to a second injection of horse serum, whereas they respond actively to a subsequent injection of the same serum used for the first injection.

We have further shown§ that the specific nature of this phenomenon is more marked when proteid substances of widely different nature are used at the first and second injections. Thus a guinea pig sensitized with horse serum does not react to a subsequent injection of egg-white, vegetable proteid or milk. A guinea pig sensitized with egg-

* Journ. of Infectious Diseases, Vol. IV, 1907, p. 552.

† Abstract of paper read before the Laboratory Section, American Public Health Association, at Atlantic City, September 30, 1907.

‡ Hyg. Lab., Bull. 29, U.S. Pub. Health & Mar.-Hosp. Serv., Washington, April, 1906, pp. 1–95.

§ Hyg. Lab., Bull. 36, U.S. Pub. Health & Mar.-Hosp. Serv., Washington, April, 1907, pp. 1–67.

white does not react to a subsequent injection of horse serum, vegetable proteid or milk. A guinea pig sensitized with milk does not react to the other proteid substances mentioned.

We have recently succeeded in demonstrating more clearly the specific character of the phenomenon we are studying by proving that guinea pigs may be in a condition of anaphylaxis to three proteid substances at the same time. For instance, a guinea pig may be sensitized with egg-white, milk and horse serum and subsequently react to a second injection of each one of these substances. The guinea pig may be sensitized by giving these strange proteids either at the same time or at different times, in the same place or in different places, or by injecting them separately or mixed. The guinea pig differentiates each anaphylactic-producing proteid in a perfectly distinct and separate manner. The animal is susceptible to the second injection of each one of the three substances in the same sense that it is susceptible to three separate infectious diseases.

These experiments, which we now wish to record, were divided into three series. In the first the guinea pigs were sensitized with horse serum, egg-white and milk, in different parts of the body, but at the same time. In the second series the three substances were thoroughly mixed and then injected into the guinea pig. In the third series the animal was first given an injection subcutaneously of milk, fourteen days later an injection of egg-white, and fourteen days after that an injection of horse serum.

All of the animals, after at least fourteen days from the last injection, were then given the second injection of one of these substances. Those animals that survived the injection of the first substance were given, usually after an interval of one day, one of the other substances used, and those withstanding it were finally tested for susceptibility to the third substance used. As will be seen from the detailed experi-

ments, some of the animals survived after having had severe symptoms as a result of injections of all three of the proteids used.

Attention is drawn especially to one of the guinea pigs (No. 1,019). This animal reacted sharply to the second injection of milk. The guinea pig presented the usual symptoms from which it gradually recovered. *Five hours* after the injection of milk it was given an injection of egg-white from which it died. These two reactions in so brief a time seem to accentuate the specific nature of the phenomenon we are studying.

The following conclusions were drawn:

Guinea pigs may be sensitized to three strange proteids, viz., blood serum, egg-white and milk, at the same time. The hypersusceptibility to each proteid substance is manifested by a second injection of the corresponding proteid. The three reactions are as distinct and specific as three separate infectious diseases. We, therefore, feel justified in concluding that the phenomenon of anaphylaxis is specific. We further believe that this work indicates that chemical changes, rather than morphological alterations, lie at the basis of this reaction.

NOTE ON METHOD OF DETERMINING TOTAL AND VOLATILE SUSPENDED MATTER IN SEWAGE*

By C. B. YOUNG and C. F. LONG

In following the method of Kimberly and Hommon for the determination of suspended matter in sewage, as outlined in Public Health, Volume 31, Part II, page 123, the workers in this laboratory experienced some difficulty with the method in that, after ignition of the suspended matter, the weight of the crucible and ignited suspended matter would fall below the initial weight of the crucible and mat alone. The writers had this difficulty with a large number of determinations, and a very large number showed abnormally high values for volatile matter, indicating that loss was taking place somewhere.

In order to dispose of the danger of the asbestos still containing some soluble matter, and to satisfy ourselves that no particles of the mat were passing through the Gooch when suction was applied in filtering, thereby causing a loss on the first weighing (before ignition), several mats were prepared in the usual manner and ignited at a low temperature for five minutes, washed with from 100 to 200 c.c. of distilled water, dried in the air bath and reweighed. The second weighing in each case checked the first, thus showing that no soluble matter was being dissolved from the mat and that no particles were being pulled through by the suction.

In the preparation of the asbestos, the washing by de-

* Contribution from the Laboratory of the Ohio State Board of Health. Read before the Laboratory Section, American Public Health Association, at Atlantic City, September 30, 1907.

cantation is very slow, as the asbestos settles slowly and loosely, and it was found preferable to stir up the asbestos with water in a beaker, then pour off through a perforated plate placed in a large funnel, finally transferring the whole contents to the funnel and allowing it to drain. Then place the asbestos back in the beaker and stir up with water and transfer to the funnel as before. By this method one does not have to wait until the asbestos settles; a much larger proportion of the washed water is also removed, thus greatly diminishing the number of washings and amount of water necessary to wash the asbestos. The cream used should contain enough asbestos that in order to make a mat of proper thickness 50 to 100 c.c. of the cream must be poured through the Gooch. Then, in order to make sure that no particles of the mat be drawn through in filtration of the sample, it is well as soon as it is formed to pour some distilled water through. We have not found that this precaution is necessary, but for new workers we would advise it.

During the course of the work various kinds of asbestos were used and experimented with, in order to determine which might be the best adapted to the above procedure. The kind finally selected was the ordinary "long fibrous asbestos," which was prepared by us as follows: Digest with strong hydrochloric acid on water bath, and then wash from the acid till the washings give no test for hydrochloric acid with silver nitrate. It was found that a mat prepared from this product, thoroughly ground in water, was effective in catching all the finely divided suspended matter.

For ignition of the Gooch crucible and asbestos filter an iron radiator was used, heated with two ordinary Bunsen burners. By this method the iron radiator was heated to dull redness, as described by Kimberly and Hommon. It was thought very probable that insufficient initial heating was the cause for the loss on ignition of the suspended matter. In order to remedy the above defect, a small nickel dish was

used, but the same difficulty was experienced. Although the ignition was continued fifteen to thirty minutes, loss continued to take place with final ignition. When, however, the blast lamp was used on the nickel radiator for ten minutes no further loss took place, and no further difficulty was experienced in securing satisfactory results. It was found that vigorous blasting for ten minutes drives off all volatile matter, and when the crucible is placed in the nickel radiator the blasting does not disturb the asbestos in any way. Ignition must be strong enough to give a very distinct red glow to the crucible itself.

The following results, which were taken from the daily notes in this laboratory, will serve to demonstrate the above:

	FIRST IGNITION	SECOND IGNITION	THIRD IGNITION	FOURTH IGNITION
Ignition for ten to fifteen minutes in iron radiator heated with two Bunsen burners.	11.8758 12.6525 12.8997	11.8742 12.6317 12.8993	11.8742 12.6314 12.8988	11.8740 12.6312 12.8985
Ignition same as above, except in nickel dish.	12.9445 12.6323 12.8734	12.9434 12.6317 12.8717	12.9433 12.6305 12.8714	....
Strong ignition for ten minutes in nickel dish heated with blast lamp.	12.1321 12.2020 12.5335 12.8037	12.1321 12.2020 12.5335 12.8037	12.1321 12.2020	....

REPORT OF COMMITTEE ON TECHNICAL PROGRESS*

Gentlemen: Your Committee on Technical Progress is a standing committee under the constitution of the Laboratory Section, consisting of the chairmen of the various Technical Committees, presided over by the Chairman of the Section. This Committee, to quote the constitution, is responsible for "the scientific work and development of the Section."

At the Havana meeting of the Section, the Technical Committees, then several in number, were cut down to two, and have never since been increased in number. It happens, therefore, that this year, the Chairman of the Water Committee and the Chairman of the Milk Committee form, with the Chairman of the Section, the total membership of the Committee on Technical Progress. Furthermore, because no report has ever heretofore been made by the Committee on Technical Progress, this report is its first.

The writers of the Section constitution had in mind that in most scientific societies every attention is paid to parliamentary organization, but very little to the organization of that which forms the main reason for the existence of such societies, the progress of the particular science or art in question. The attempt was made to provide, in this Section, an organization as complete for its purely scientific side as for its administration.

Your Committee, notwithstanding the absence of precedents for its action, has undertaken to make the following report, reviewing briefly the history of the Technical Com-

* Read before the Laboratory Section, American Public Health Association, at Atlantic City, September 30, 1907.

mittees of the Section to date, and making certain recommendations, with the hope that the Section will accept them as a basis of discussion.

The Laboratory Section was organized in 1899, primarily as the outcome of the success which greeted the efforts of the well-known Committee on Standard Methods of Water Analysis of the General Association. That Committee became a Technical Committee of the Section and continues as such today. Committees on various other subjects were from time to time appointed, but heretofore but small progress has been made, especially since the Havana meeting, when the existing committees were nearly all abolished. Since that time only the Milk Committee has been newly appointed.

RECOMMENDATIONS

Your Committee believes that the results achieved by the Committee on Standard Methods of Water Analysis justifies the Section in continuing its own policy, as exemplified in the appointment two years ago of a Committee on Standard Methods of Milk Analysis, and recommends the appointment of Committees on Standard Methods for the various public health services, and would specify, as called for, a Committee on Standard Methods of Diphtheria Diagnosis, of Typhoid Diagnosis, of Glanders Diagnosis, of Rabies Diagnosis, of Sputum Examination, Syphilis Diagnosis, Gonorrhœal Diagnosis, of Sewage Analysis, of Air Analysis, on Standard Methods of making vaccine, antitoxin, mallein, tuberculin, etc., all as applied to public health work, and also on Mailing Infectious Material and the examination of Embalmers' Fluids.

Your Committee feels that the work of these Technical Committees of the Section should not cease with the standardization of methods; methods should be as uniform, exact

and rapid as may be compatible with obtaining the results desired. But the termination of the analysts' work and the announcement of the technical result is but the initiation of the course which that result must run before its true value has materialized. It is very much indeed to obtain a certain analytic result quickly, accurately and by methods applicable to the examination of large numbers of specimens. The most refined results, however, are no better than the most crude, or than none at all, if their meaning is not made known also. It is usually assumed that those capable of securing the technical results must know what those results mean, a totally unwarranted assumption. As the expert telegrapher need not, often cannot, even guess at the significance of a message he transmits, so the analyst need not, often does not, know what his results mean, chiefly because they can seldom be interpreted directly, but generally require other data, not analytical, in conjunction with which they alone become valuable. Interpretation of results should be attacked by your Committee, we believe. As the standardization of methods was at one time believed to be a hopeless task, but is now an accomplished and accepted fact, so also we believe the interpretation of results, an even wider and more complicated field, should be, and with earnest effort will ultimately be, formularized and established.

Your Committee would also suggest that the plan heretofore usually followed, whereby the appointing of Technical Committees by the Council is done without consultation of those appointed, be modified in such a manner that the committees to be appointed may be known beforehand, and members who may wish to serve on such committees be asked to state their preferences. The efficiency of a member of a Technical Committee is usually dependent upon the trend of his own work during the time he is a member; the fact that a Section member has already become well known in relation to a given subject is not a guaranty of efficiency

upon a committee dealing with that subject, for his work and interests at the time of appointment on the committee may be in a quite different direction.

H. W. Hill, *Chairman (ex officio)*.
F. H. Slack.

(Mr. H. W. Clark, the third member was not present.)

[Editor's Note. — The Laboratory Section, in session at Atlantic City, Sept. 30, 1907, accepted this report and went into committee of the whole to discuss it. As a result, the Section voted that the Council of the Section should undertake the carrying out of the recommendations made, prepare a list of committees, secure an expression from each member of the Section as to his preferences, and, on the basis of these returns, appoint the committees.]

TECHNICAL COMMITTEES OF THE LABORATORY SECTION, A.P.H.A.

By vote of the Council of the Laboratory Section, the following committees have been appointed:

Committee on Standard Methods of Bacterial Water and Sewage Analysis, D. D. JACKSON, Mount Prospect Laboratory, Brooklyn, N.Y., Chairman.

Committee on Standard Methods of Chemical Milk Analysis, PROF. J. O. JORDAN, 30 Huntington Avenue, Boston, Mass., Chairman.

Committee on Standard Methods for the Bacterial Diagnosis of Diphtheria, MR. B. R. RICKARDS, 739 Boylston Street, Boston, Chairman.

Committee on Standard Methods for the Bacterial Diagnosis of Typhoid, DR. F. F. WESBROOK, University of Minnesota, Minneapolis, Minn., Chairman.

Committee on Standard Methods for the Bacterial Diagnosis of Tuberculosis, DR. M. P. RAVENEL, University of Wisconsin, Madison, Wis., Chairman.

Committee on Standard Methods for the Analysis of Air, PROF. C.-E. A. WINSLOW, Massachusetts Institute of Techonology, Boston, Chairman.

Committee on Standard Methods for the Diagnosis of Rabies, DR. ANNA WILLIAMS, Research Laboratory, East 16th Street, New York City, Chairman.

Committee on Standard Methods for the Bacterial Diagnosis of Glanders, DR. W. L. BEEBE, St. Anthony's Park, Minn., Chairman.

Committee on Standard Methods of Preparing Diphtheria Antitoxin, DR. H. D. PEASE, State Antitoxin Laboratory, Albany, N.Y., Chairman.

Committee on Standard Methods of Preparing Smallpox Vaccine, Dr. J. H. Huddleston, 126 West 85th Street, New York City, Chairman.

Committee on Standard Methods for the Preparation of Tuberculin and Mallein, Dr. V. A. Moore, Cornell University, Ithaca, N.Y., Chairman.

OTHER COMMITTEES

Committee on Mailing Infectious Material, Dr. M. L. Price, Secretary State Board of Health, Baltimore, Md., Chairman.

Committee on Standard Methods for the Bacterial Diagnosis of Syphilis, Dr. H. U. Williams, University of Buffalo, Buffalo, N.Y., Chairman.

COMMITTEES PREVIOUSLY ESTABLISHED

Committee on Standard Methods of Chemical Water and Sewage Analysis, Prof. E. B. Phelps, Massachusetts Institute of Technology, Boston, Chairman.

Committee on Standard Methods for the Bacterial Analysis of Milk, Dr. F. H. Slack, 739 Boylston Street, Boston, Chairman.

The committees just appointed will be expected to plan their work for the coming year and to furnish the Section with a short report of such plans at the coming meeting in August. The Chairmen are referred to Section 30 of the Constitution (Transactions, Vol. XXXI, Part II, page 254) for information relating to the addition of advisory members to their committees, and also to Sections 28 and 29 for other information for their guidance.

B. R. RICKARDS, *Secretary*,
For the Council, Laboratory Section.

The Massachusetts Association of Boards of Health

APRIL QUARTERLY MEETING
Boston, Mass.

The quarterly meeting of the Association was held at the Brunswick Hotel, Boylston Street, Boston, on Thursday, April 30, 1908. President Walcott presided at the dinner, and Vice-President Durgin at the business meeting which followed it.

VICE-PRESIDENT DURGIN. It is moved and seconded that the reading of the records of the last meeting be dispensed with.

The motion was adopted.

VICE-PRESIDENT DURGIN. The Executive Committee have a report to make which the Secretary will read.

MR. COFFEY. The Executive Committee recommend the following for membership: Edward H. Gallup, of the Hyde Park Board of Health; Dr. Elliott Washburn, State Inspector, Taunton, Mass.; Dr. Merrick Lincoln, of the Worcester Board of Health; Prof. Charles F. Nixon, Bacteriologist of the Leominster Board of Health; Dr. Carlisle Reed of Boston; Dr. Homer L. Conner of the Haverhill Board of Health; Charles M. Hickey, Chairman of the Brockton Board of Health; Dr. Winfred L. Howe of the Everett Board of Health; Dr. W. J. Sleeper of Westford; Dr. George W. Dow, Medical Examiner, Lawrence; Zebedee E. Cliff of

the Somerville Board of Health; Wm. G. Kirschbaum, L. Z. Normandie, M.D., and S. M. Kennedy, D.D.S., New Bedford.

The gentlemen named were elected members of the Association, on motion of Dr. Rose.

VICE-PRESIDENT DURGIN. The first business on the program is a paper on, "The Transmission and Methods for Control of Measles," by Dr. D. D. Brough of Boston.

THE TRANSMISSION AND METHODS FOR CONTROL OF MEASLES

By DAVID D. BROUGH, M.D.
Medical Inspector, Boston Board of Health

The problems that confront a Health Board in the prevention and care of infectious diseases vary with each kind of disease. It is impossible to lay down any general law to cover all the cases; no absolute rule can be laid down for a method of procedure. We should, as far as possible, adapt our knowledge to a scientific basis. In smallpox we have an absolute safeguard for the public in vaccination, but even today we have persons, even physicians, who are so short-sighted as to deny its efficacy. In other diseases, as diphtheria, where we have an antitoxin both as a curative agent and a valuable immunizing factor, there still arise questions that health officials are not yet agreed upon, as what to do with diphtheria bacilli which are present in well persons, and what to do with persistent bacilli in convalescents. Typhoid has its problems, with the long continuance of the bacilli in the stools or urine. In leprosy the question of complete segregation has not been completely settled.

When we come to the question of a disease of the nature of measles, where we have no absolute knowledge of the cause, and where no vaccine nor immunizing agent has yet been discovered, we find varying opinions among health officers and physicians. Each man feels he is a law unto himself.

Measles is a very old disease. It is said to have made its appearance first on the regions bordering on the Red Sea. The first clear mention is by Rhazes, an Arabic physician,

in 910 A.D. It was not until 1670–1671 that is was clearly defined and differentiated from smallpox by Sydenham.

Bacteriology, up to the present, has given us nothing definite as to the cause of measles. A large amount of work has been done by painstaking workers. Bacilli have been found in the blood by some, and others have found organisms which they claim to be protozoa, but nothing absolute has yet been agreed upon.

Inoculation experiments have proved at times to be apparently successful, but the element of human infection has not been eliminated. With the exception of inoculation by nasal mucus by Hebra and the two cases of Hektoen with blood, authorities still doubt the inoculability of measles. All the successful inoculations that are claimed to have been done have been performed with the blood or mucus in the very early stages. All inoculations with the scales of desquamation have proved negative.

INFECTIOUS NATURE AND GENERAL SUSCEPTIBILITY TO THE DISEASE. Almost every one is susceptible to measles; it attacks all races and appears in every part of the world. Those who are exposed to the disease and do not contract it have almost invariably had measles at some previous period. Adults, old age, youth and children all contract it. There is one noticeable exception, children under six months of age have a relative, if not absolute, immunity, or are rather less susceptible than at other ages. In the records of 7,690 consecutive cases of measles in Boston Board of Health reports, I can only find 85 cases of 6 months and under, and of these only 41 were under 6 months. These are not accidental figures, but appear in a study of the health records of measles everywhere, and most writers agree on this fact. Why this relative immunity is hard to explain. In an outbreak in a hospital where there were 40 children under 1 year, only 7 acquired the disease; while in out-

breaks in schoolrooms in this city practically all the children acquire the disease. In one class in this city, of children between the ages of 5 and 7, out of 44 children only 6 escaped.

In large cities the disease is always present in endemic form. In Boston some sections will have the disease, while other parts will be free, then suddenly finding suitable soil it breaks out in epidemic form.

PROTECTION BY ONE ATTACK. It may be stated in a general way that one attack usually protects for life. Secondary cases are rare, though they are occasionally reported. I have at times seen cases of measles where the patient has claimed to have the disease before. The absence of definite proof regarding the nature of the first attack should make us accept such statements with caution. Sometimes what is claimed as a second attack will be found to be some other disease. Careful observers of numerous cases find few second attacks.

Panum, in the outbreak in the Faroe Islands in 1846, did not see a second attack among six thousand cases.

Hoff, who investigated a second outbreak in these islands in 1875, is inclined to doubt if second attacks occur.

Williams, in twenty years' experience, did not see one secondary case.

Widowitz * declares that among several thousand cases he could observe only one instance of a second attack of measles.

Camby, in seven hundred cases, did not see a second attack.

Experience indicates their great infrequency. Many cases of what are called secondary attacks may be due to errors in the diagnosis of the primary case.

Cases where an eruption reappears in a very short period

* Pub. Health, August, 1907, p. 693.

are really instances of auto-infection or relapses rather than second attacks.

MORTALITY. The disease is most fatal in the early years of life. The number of deaths in the years from one to five is always much greater than the years from five to fifteen. Therefore if there is a desire to reduce the mortality the effort must be to prevent the children in the early years of life from acquiring the disease.

Dr. Eberstaller, in his records of sixteen years for the town of Graz, Germany, finds that in the first year the mortality runs as high as from 16 to 35 per cent. It is fortunate that children under six months are not very susceptible, or we would have a tremendous death rate. In the ages from one to five he found the rates from 2.6 to 5.5, while in children from five to ten years it is only .1 to .3 per cent.

In London the death rate is five or six times as great in the first two or three years as it is after five years. Out of the deaths from measles in England, 1862–1872, nine-tenths occurred in the first five years. Out of 367,000 deaths from measles in England from 1848–1887, 335,000 occurred in children under five years.

In the State of Connecticut reports from 1894 to 1903, out of 1,036 deaths from measles, 799 were under five years. In the United States Census reports, 1900, in the list of registration cities, 3,091 died from measles; 2,696 were under five years, while only 395 were of the ages from five to fifty-nine.

The same kind of figures can be duplicated in many health reports that I have consulted from various parts of the United States. Measles is not the light and trivial disease to be carelessly treated. In the circular sent out by the Chicago Board of Health it is stated that the mortality in children under two years is about one in five cases. If children must have the disease, the later the better. Health

Boards must take action in preventing epidemics of the disease.

MORTALITY COMPARED WITH SCARLET FEVER. We are inclined to look upon measles as a light disease and scarlet fever as a severe one. Yet the deaths from measles are actually more in most places than from scarlet fever.

I select a few instances at random:

In census (1900, U.S.) in the registration cities, 3,091 deaths from measles; 2,796 deaths from scarlet fever.

In ten years in Connecticut, 1894–1903, 1,036 deaths from measles; 839 deaths from scarlet fever.

In 1904, New York, 895 deaths from measles; 556 deaths from scarlet fever.

In 1904, Birmingham, England, 204 deaths from measles; 65 deaths from scarlet fever.

In 1906, Philadelphia, 344 deaths from measles; 65 deaths from scarlet fever.

In the reporting towns in Massachusetts, 1904, 1905, 1906, 500 deaths from measles, 326 deaths from scarlet fever. Each year showed more deaths from measles than from scarlet fever.

In Boston during the last six years we have had 349 deaths from measles, 324 deaths from scarlet fever.

It can be seen that in the preventable mortality measles is an important factor.

INCUBATION. In regard to the incubation period our knowledge is based on the epidemics in the Faroe Islands, belonging to Denmark. There the great majority of cases were found to have an incubation period, that is from the reception of the infection organism into the system until the first noticeable symptom appeared, of ten days; from the infection until the eruption generally fourteen days.

A committee appointed by the Boston Society for Medical

Improvement, consisting of Dr. S. H. Durgin, Dr. Elbridge Cutler, Dr. McCollom, Dr. Morse, Dr. Cabot, reported, after careful consideration, that the average incubation period is eleven or twelve days. It may be ten; it may be as long as twenty-one.

In a Special Committee report by the Massachusetts Medical Society, seven or eight years ago, consisting of Drs. Cutler, McCollom and Adams, the results given were: incubation, eleven to twelve days; maybe ten; shorter at times.

In a paper to the Massachusetts Association of Board of Health in October, 1899, Dr. Cutler stated:

"The incubation period of measles is eleven to twelve days. It may be ten, or possibly shorter. On the other hand, it may be as long as fourteen days."

My own experience, where I have been able to time accurately the period of incubation, has been from ten to eleven days to the appearance of the first symptoms.

TRANSMISSION OF MEASLES IN THE PRE-ERUPTIVE STAGE. Over fifty years ago Meyer,* in a chapter on measles, stated that measles was infectious even in the prodromal stage, and this observation has been verified by numerous observers since. It is one of the common ways by which the disease is spread.

Von Kerchensteiner, in the Munich outbreak in 1855, found that in thirty-four cases, ten or twelve days lay between the eruption in the infecting and infected child. Now, as we know the incubation period is about eleven days and the prodromal three to four days, the infection must have occurred in the prodromal period.

In the Infants' Hospital in this city recently a child was bathed in a hot bathroom, and then several other children used this room. Nothing developed on the first child until,

* Verchow's Handbook of Special Pathology and Therapeutics.

two days later it was found to have measles. Three children, who had been exposed in the pre-eruptive stage, came down with the disease. (Dr. J. L. Morse.)

The infection comes chiefly in prodromal stage from the eruption on the mucous membrane, when every cough throws minute droplets into the air to which the infectious material probably adheres. The measles organism seems to resemble a plant that, taken from the soil that nourishes, unless it is at once transplanted into suitable soil, withers and dies.

The Medical Officer of Health for Coveney reports: "Thirteen children attended a dancing class, among whom were two of a friend who had arrived in this district, having come from a place where they had been exposed to measles. There was nothing to attract attention to their condition. The next day, however, they sickened of measles. Within fourteen days eleven of the children came down with the disease, only two who had had it escaping. As they were only associated this day the disease must have been spread in the prodromal stage.

TRANSMISSION IN THE ERUPTIVE STAGE. In the eruptive stage there is abundant evidence to show that it is highly infectious and all observers are agreed here. "From the beginning of the prodromal stage," says Welch, "to the complete disappearance of the eruption is the time of infection."

In the later or desquamation stage there is no direct evidence to show that it is infectious.

TRANSMISSION OF MEASLES. One function of the Boards of Health is to spread true ideas of infectious diseases and to dissipate false. One of the most common ideas, both among the public and also among many physicians, is that the disease is spread by fomites or third persons. In measles the mode of contagion is by direct exposure. It is spread from one case to another. In literature a few cases have

been ascribed to fomites, or to intermediary infection. They are, however, few, and the exclusion of personal infection has not been established.

The opinion of most observers is that the infective element is short-lived, and does not live away from the infected person.

In dealing with a disease as measles, where the cause is unknown, we have to rely on the conclusions drawn from a large number of observers.

Richard (*Ther. Gazette*, July 16, 1888) claims contagion of measles cannot be carried by fomites or infected persons.

Bard (*Revue d'hygiène*) states the contagion does not remain viable in a locality from which patients have been removed.

Comby (*Traité des mal de l'enfance*) states germ of measles has little viability outside body, and every germ that radiates is dead in a few hours.

Welch (on Contagious Diseases), referring to carrying contagion by fomites, "Our experience is in accord with most writers that such cases are very rare."

Official Danish reports of 6,000 cases in the Faroe Islands give no instance of transmission by infected articles or by third or intermediary persons.

Rurah, in *Osler's Mod. Med.*, 1907, says: "Measles is transmitted by direct contact in nearly every instance. It is probable that the disease may be transmitted by fomites, if the time elapsing is not great, but it is rare for it to be contracted from an apartment occupied by a measles patient." In regard to this statement I can find no instance where it ever has been contracted from an apartment occupied by a measles patient — nσ such instance in this city.

In conferring with a large number of physicians I can find none who have, in their experience, known of a case being contracted by fomites or from rooms or from intermediary persons.

At a meeting of the Medical Inspectors of Boston, some years

ago, Dr. S. H. Durgin called for an opinion on this subject. The practically unanimous opinion was that it could not be transmitted in this manner.

Investigations amongst physicians who see a great many cases, and are constantly exposed, reveal no evidence of measles appearing earlier in physicians' families than in others.

If the disease cannot be carried, then the necessity for keeping well children at home who have had the disease need not be considered. Formerly our law compelled us to keep all children out of school until seven days after recovery. Now the law allows the attending physician or the Board of Health to give a certificate stating that all danger of infection has passed. This can safely be done in measles cases, even when there are others ill in the family, for they cannot be carriers of the disease.

If children could only be given certificates after they have had measles, which could be placed on file in the schools, something as vaccination certificates are given, I believe it would be a very distinct advantage.

On the question of the transmission of measles, Von Kerchensteiner, health officer for Bavaria, brought it up for discussion in the Munich Medical Society, and in addition called for reports from all sections of Bavaria. The opinion was almost all negative that measles could not be carried.

Some work was attempted in Philadelphia by Dr. Graham and Dr. Harmitt, on the transmission of measles by fomites, but was given up from lack of material and evidence.

The disease, so far as evidence goes, is only spread from the sick to susceptible persons. When one is well from the disease, which we may regard when all signs of catarrhal symptoms and desquamation have ceased, all danger has passed. If there is any possible danger from any other method it is so infinitesimally small as to be entirely neglected.

Among our Boston physicians I can find no authenticated cases of transmission by fomites or by intermediary persons.

Dr. J. L. Morse thinks the organism may live for a few hours after the removal of the infected person.

Dr. E. G. Cutler says that he never in his thirty-three years' experience saw a case where it had been transmitted, except possibly in one instance. That was the case of a nurse who attended a measles patient, and wiped away mucus. She used the same handkerchief on another child to wipe its face, and the second case developed measles. It may have caused it, but he would not hold to it.

Dr. J. H. McCollom never saw or knew of a case of transmission by fomites in his experience.

All stories of transmission by post cards and letters are treated as fables by Von Jurgensen (Nothnagels' Encycl. Pract. Med.).

The following are related as the most convincing instances of transmission by fomites and intermediary persons.

A tailor worked on a boy's suit of clothes in the same room in which his own children were ill with measles and carried it to the boy's house to try on. This boy was taken ill with measles after proper incubation. If this had occurred in an out-of-the-way place where every opportunity for infection was known, it would be a strong argument, but as the place was Dresden, and an epidemic was prevailing at the time, it does not carry much weight.

A physician, during the outbreak in the Faroe Islands, visited a village where no measles was present. He was rowed four miles in an open boat. As he came from an island where measles was present, and fourteen days later measles broke out in the house where he slept, it was supposed he carried the disease. But Hoff, who investigated the case, found that one and probably several of the boat crew had the disease and slept in the village with the doctor, and that they were probably the carriers.

As Dr. A. H. Doty says: "Cases which upon superficial investigation may appear to be transmitted by clothing, etc.,

are, upon exhaustive investigation, commonly found to be caused by the presence of other cases."

The negative evidence of immediate transmission is so great and so abundant that such cases must be proved beyond a doubt before they can be accepted. We have numerous cases of infected clothing being carried by laundresses and others to susceptible households, and yet we hear of no case of transmission. Look at the immense number of books from libraries and schools from measles households, and yet we hear of no case of transmission.

Flindt reports a case on the Island of Samsoe:

"In one school the same room, books and desks were used by two classes. The younger used the room in the morning and the older in the afternoon. In the younger the disease was prevalent for more than a month before it appeared in the upper class and only here after some of its members contracted it at home, and then it spread as it had in the other class." This he says is conclusive evidence to me against its being spread by articles of use.

In the history of outbreaks of various infectious diseases it has been found that water, milk or some articles of food have been carriers of contagion. In typhoid the records are numerous. In diphtheria and scarlet fever there are frequent and well authenticated cases. In our own city several outbreaks of scarlet fever and possibly diphtheria have been traced to infected milk or some food supply, but never can I find either in this city or elsewhere any outbreaks of measles having been caused or suspected to have been caused otherwise than by direct infection.

NOTIFICATION. The first step in the control of an infection is that the cases shall be reported to the central office and a record of all reported cases kept on file. As time goes on Health Departments find it necessary to extend the scope of their compulsory notifications. Every

Health Department finds, sooner or later, that some method must be taken to check measles. Up to 1882 measles was not reported in Boston.

In 1882–1883 the Boston Board of Health, in view of the increase in deaths from measles, began to take more stringent action in regard to the disease. As the report of that year says, "Measles is now increasing and steps will at once be taken to check the disease," and calls for more room for isolation and to insist on having the cases reported. In 1883 cases first began to be reported, slowly at first, but gradually increasing, and no one doubts that this has been of great value.

Some seventeen years later similar ideas are expressed in the report of the health officer of Birmingham, England. He endeavors to get the addresses of the cases and to send circular of instructions, so that necessary precautions may be taken.

In 1901 the London County Council placed measles on the list of dangerous infectious diseases. I find the reports of health officers over this county appeal for more care in this disease.

There has been a steady improvement in the number of cases reported in this city, and proportionally more are reported than ever. A great many cases are treated without a physician and are not reported, although the family are legally obliged to do so. I hope the time will come when the public will have true ideas on the seriousness of the disease, and it is on health boards that the responsibility for the spread of correct ideas must fall.

It is no argument to say that because many cases are not reported that it is useless to trouble about reporting at all. The same may be applied to any of the other infectious diseases where cases are still not reported.

When as many years have been devoted to educating the public on the subject of measles as in other diseases, we will have a great improvement.

For any efficient health work to be done in measles it is necessary that all cases possible be reported.

It is a question whether rubella, or German measles, should not be added to the list of compulsory notifications. It seems to me that the disease is a distinct entity, and, lying as it does on the border between measles and scarlet fever, public safety would demand its report.

It is advisable, also, that physicians should, if possible, visit again a case that has been treated as rubella, or German measles, in a week or ten days to see no error has been made. Occasionally I have found cases treated as German measles desquamating freely, showing that they were really cases of scarlet fever. Any danger of error would be obviated if the attending physician made a later visit.

ISOLATION. The next step in the control of a disease is isolation. If we wish to do anything we cannot stop at simply notification. Therefore the next procedure is to see that the cases are isolated at home and the family instructed into the care of the disease. The medical inspectors in Boston now visit the home of every case of the disease. I know it seems a hopeless task, yet a beginning must be made. Parents treat it too lightly. I believe that to every family where measles is present some card with simple directions should be sent, as is now done in Boston.

It is only in a comparatively small number of places in the city that we can get good isolation; the isolation of the wealthier parts of the city and the suburban districts is, of course, very different than from the crowded parts of the city. Where there are only two, three, four or five rooms, one feels as if it were hopeless to attempt to isolate. But it must be done. The family can be told to keep the sick child in and watch the susceptible children. Keep the sick ones in and do not have other children running in and out. Tell them the seriousness of the disease, how it is spread,

and have them try and do something. If we do not instruct, educate, try to do something in the way of isolation, then we must give up. For it would be impossible for any city to build hospitals large enough to care for all measles patients. As one physician said, if no precautions are to be taken, what is the use in reporting cases?

The carrying power of measles is probably not great. If the case is isolated early, much may be done to keep others in other apartments from getting the disease. All visitors and all not members of the family should be kept away. Household companions should be kept out of school if they have not had measles. Those who have had the disease can go out or return to school.

Our efforts must go to home isolation. If that fails we can do little. In spite of the fact that we are soon to have a measles pavilion in Boston, all that that can do will be to provide accommodations for the cases arising in the various institutions, lodging houses, hotels, etc., where the demand for hospital accommodation will be imperative.

It is impossible to set any absolute time on the period of isolation. The time limit is an indefinite thing. Detroit fixes one week, Buffalo two weeks, Brookline and Fall River two weeks after the eruption fades. Other towns have no definite period, but make the regulations elastic enough to fit the case.

The child should be kept in isolation until all symptoms disappear, all signs of cough, coryza, conjunctivitis and desquamation, and this time may vary in different cases.

Isolation means the exclusion of all children who have not had the disease from school as well as keeping the sick child in a separate room, and absolutely keeping out of the house all strange children. During the first week after exposure it is not absolutely necessary for all the children to stay in the house, but during the second week after exposure this should be insisted upon.

PLACARDING. I believe that considerable good would be done by placing a warning card on the room that the sick patient occupies. It would certainly make the family feel that something was being done. But to put a card on the outside of the house and on the tenement, informing the public that measles is present, is more serious. It is a good thing to put a card up, especially in the more crowded districts. It will certainly keep the sick in and the well and visitors out. But the opposition of the public to more stringent health regulations is always strong. People object strenuously to notices being placed on their houses. Would there result a diminution of the number of cases being reported if the houses were placarded?

I am of the opinion that where the isolation is satisfactory then the need of placarding is less imperative. It is only where the isolation is poor that some other methods are needed to protect others.

Dr. Chapin of Providence thinks there is nothing so little trouble to Health Departments or causes so little trouble to the family as placarding. In Philadelphia, however, many of the medical profession are strongly opposed to it.

The difficulty is this: where the people are intelligent and willing, isolation is well carried on without placarding. Where the people are careless, they do not seem to care; whether the card is up or not it seems to make no difference.

DISINFECTION. The question, shall we disinfect after measles? is constantly arising. There is nothing the public likes to rely on so much as disinfection. There is a constant call for disinfection, without any real basis for the same, that health boards often yield to it as the simplest way out of the dilemma. If there is no real ground for it I do not see why it should be done. It opens a very large question of expense and trouble. It makes no difference whether disinfection is done or not. The result is the same. In

schools when the children who are capable of transmitting the disease have been excluded, and the proper period of incubation has passed and no new cases appear, the disease is stamped out. No one can get the disease except from a fresh case of the illness.

The question of disinfection has been seriously considered in other countries.

Some careful work on the question of the retention of infection of measles in houses was carried on in Brighton, England, as given in Dr. Newsholmes's Annual Report for 1904:

"In 1904 there was an epidemic of measles in Brighton, England. It occurred in the spring, and in August and September of the same year every house was visited in which, during the previous seven months, cases had occurred. No disinfection had been carried out in any of these houses. Six hundred and twenty-five houses had been invaded. In 534 of these the occupants were the same as in the first visit, and no further occupants had been attacked. The immunity of 169 children in these houses, who had not previously acquired measles, had continued. Of the remaining houses twenty-three were found to be empty, and in sixty-six of these new families were living or new babies born. Eighty-six children had come into these presumably infected houses. The duration of their exposure was from seventeen days to four and one-half months. None of them acquired measles. It is justifiable, therefore, to presume that the entire experience points in one direction, that the infection of measles is short-lived, and that domestic cleaning suffices for disinfection."

Personally I am of the opinion that this is all that is necessary.

I covered rather closely the point on the transmission of measles. The disease is a personal one from sick to well. The care should be for the patient and not the things. If we

are to agree with practically all the evidence, both in this country and abroad, that measles is spread from person to person and that there is no transmission by fomites or intermediary persons, that the rooms after the recovery of measles patients are not infected, then it is unnecessary to disinfect. This is the position today of the best authorities.

Of course, where large Health Departments adopt disinfection, the influence of those bodies has great weight with the public and the inference is drawn, be it right or wrong, that the disease is spread by fomites. In New York City measles is treated the same as scarlet fever or diphtheria. Outside of that city it is not generally done.

In a discussion, reported in January, 1908, Brown Medical Officers of Bermondsey, one of the London districts, states: "Disinfection (in measles) is unwise, as it can accomplish no appreciable good, and is expensive and annoying."

Opinion of Dr. J. L. Morse is sound, that it is a short-lived organism, and that airing the room for twenty-four hours is amply sufficient.

Dr. Elbridge Cutler does not think it worth while to disinfect, the vitality of measles disappears and it practically disinfects itself. It is not necessary, though it may give a sense of security to the family.

The prevalent opinion on the Continent is that it is unnecessary. Dr. O. Heubner of Berlin (Mod. Clin. Med.) says: "Poison only develops in man, and not outside of the human organism, for in his surroundings it does not remain active very long, for even a residence in places in which measles patients have been previously present a few hours after careful ventilation confers no danger to susceptible individuals."

MEASLES IN SCHOOLS. In schools it is known that one case rarely produces an outbreak. The first case usually infects a few and often those near the infected child. The second crop of cases are those that infect the whole rooms.

Casper, in the Vienna *Clinical Weekly*, in 1898, noted that the first case infects the others from the ninth to thirteenth day after the sickening of the first child, and he proposed that schoolrooms should be closed for five days from ninth to thirteenth day, so that the second generation of cases should be excluded in the prodromal stage, and when school is opened the sick children would be out. Dr. Eberstaller of Gratz followed this method and found it very successful. In some cases a partial closure might be tried.

If there is not partial closure of the schoolroom then the school physician, teacher or nurse must carefully examine the children every day from the earliest to the latest period of incubation for the first symptoms that may point to measles,—the cough, suffusion of eyes, coryza, any indisposition. The buccal membrane should be examined for Koplik's spots. At any sign of illness the children should be sent home. Those sitting near the first case should be most carefully examined. Every effort should be made to limit the disease to as few cases as possible. If nothing is done the room will practically be closed on account of the large number of cases. It is in the schools that much valuable work can be done.

CONCLUSIONS. We know that measles is disease with a definite period of incubation.

It is spread in the pre-eruptive stage and during the period of eruption chiefly.

The infective principle is short-lived organism and does not live away from the sick person, if at all, more than a very short time.

The evidence of it being transmitted by fomites or intermediary persons is not sufficient for this to be considered as of practical importance.

There is no reason for disinfection. It is a needless expense and annoyance. Practical results can be accomplished as well by thorough airing of the room.

Reporting all cases should be insisted upon.

Isolation, as far as possible, should be tried.

Circulars should be sent to all cases with simple directions regarding the disease.

A limited amount of placarding may, in certain cases, be advisable.

VICE-PRESIDENT DURGIN. This paper is now open for discussion. Perhaps Dr. Chapin could tell us something about Providence.

DR. CHAPIN. Mr. Chairman, I was very much interested in this paper. It is certainly excellent, and the Doctor has shown us very conclusively that it is useless to disinfect after measles. I should very much like to see the experiment of closing schoolrooms when the first case appears, after the method adopted in Austria, tried officially in this country. It seems to me that that is one of the most hopeful things to be tried. As was shown in the paper, it is important to postpone attacks of measles from early to late childhood. It is in our kindergartens that measles most prevail, and if the outbreaks can be warded off for a year or two the mortality will be greatly lessened. The custom frequently is, in this country, to close schools after ten or twenty per cent of the children have the disease, but I am inclined to think that the logical way is to close them a week after the first child has the disease. I have not tried this in Providence, but I think it would be an excellent thing. I hope other health officers will try it.

Measles is the most discouraging disease that we have to deal with. As was shown in the paper, in New York they have been trying to treat it very much as we treat scarlet fever in New England. They have been at it six or seven years. I notice that their weekly bulletins now show that

they are having a great deal of measles; I should judge more than they ever had before.

If any of you are interested in measles, I should advise you to get a report issued by the health officer of Aberdeen, Scotland, a few years ago. It contains a great deal of very valuable statistical matter, but the most interesting part is that which refers to the management of the disease. For about twenty years before 1902 they had, in Aberdeen, applied scarlet-fever methods to measles. They had isolated the cases in the family, kept them out of school, and disinfected. They had a little more measles during those twenty years than they had in the preceding twenty years, and they had just about the same amount of measles that they had in Edinburgh, Glasgow and other Scottish cities. According to the figures, comparing their measles cases with their birth rate during this period, I should judge that notwithstanding the stringent methods of isolation and disinfection adopted, about ninety per cent of their children, at one time or another, had measles. Preventive measures were not a great success in Aberdeen.

In regard to second attacks, what was said is undoubtedly so, that most of the alleged second attacks are not really such. But I remember seeing one case in Providence not long since. A young woman, twenty years old, was sick with measles, seriously sick; it was a typical case. The attending physician had seen her about ten years before when she had measles, and the case, he assured me, was a perfectly typical case, every symptom well developed. Unfortunately she died in the second attack. I am sure that such second attacks do sometimes occur.

MR. NEWCOMB. Is n't it the fact, Dr. Durgin, that under the law of 1907, which requires the reporting of cases, the seemingly greater number of them is made more apparent? That law of the State Legislature enumerated

measles among those diseases dangerous to public health. We find in some of our principal cities — we do in Salem — a larger number of cases reported than used to be. That being the case, does n't it, in a measure, account for what might appear to be an increase in the number of cases?

VICE-PRESIDENT DURGIN. I can only say, in answer, that never before have I seen the disease increase so rapidly as since we doubled our activity in trying to prevent its spread in Boston. I think our number of new cases today is 109.

MR. COFFEY. Mr. Chairman, I was very much interested recently in reading a book that has just been published, giving the Lane lectures of Dr. John C. McVail. He is the county medical officer for a part of Scotland, and these lectures were delivered in San Francisco in August, 1906, at the Cooper Medical College. He gave statistics in reference to the disease in Scotland, near Edinburgh. In an epidemic they had in an urban district, of 1,401 cases, there were 119 deaths, with a mortality of 8.5. These deaths were distributed as follows: under 1 there was 9.6 per cent; 1 to 2, 19.7; 2 to 3, 10.2; 3 to 4, 4.9, and 4 to 5, 1.5. Between 5 and 10, 160 cases, 1.1 mortality; over 10, 39 cases and no deaths. His advice, and the inference that is to be drawn from his lecture, is that something ought to be done to tide over the early ages of childhood, as the writer of the paper has said, and that after five years of age the mortality is very light.

I believe that in one district in London they are now trying the experiment of closing the primary school as soon as the first case appears, that is, within a week after the first case appears they close the school, and they are conducting experiments along that line to see if they cannot control the disease until the children are over the susceptible age. I should judge, too, from the lecture, that a great

many places in Scotland and England that had formerly required measles to be reported have discontinued that practice, discouraged and disheartened, as Dr. Durgin is, perhaps, judging by the remark he has made. They have ceased over there in a great many places requiring it to be reported, because of the fact that no effect seemed to be had in diminishing the number of cases or the mortality. Still they hope by this new method of closing a school on the appearance of the first case to accomplish good results. Dr. McVail tried it in one school in his district. By closing the school nine or ten days after the first case appeared he succeeded in keeping the number of cases down. When the first case appeared, several children were affected, ten or twelve I think he said, and by closing the school no other cases developed from that original case. But it must be said that the case was in a country district, where the children were scattered in isolated farmhouses, and it is not to be compared with our city conditions, where the children, if they are not together in school, are likely to be together in the streets or in adjoining yards, and perhaps it would not be as effective in city cases as it would be in the country.

Dr. McVail also gives figures for England and Wales for the forty years ending in 1887. The deaths from measles reached the enormous total of 367,602 in those forty years. This disease is supposed to be so trivial that most mothers want their children to have it when they are small and get it over with, yet in forty years there were 367,602 deaths, and of those only 31,728 were over five years of age, showing the enormous excess during the early years of the patients. Taking a decade, he gives the deaths between 1861 and 1870 as 391 per million of the population, in 1871 to 1880 as 378 per million, in the next decade as 406, and in the closing ten years, between 1891 and 1900, as 414 per million, showing that it was constantly increasing in those countries.

Dr. McVail does recommend that something should be done

in reference to the matter, however, something in the way of isolation and of experimentation, and he advises that when the first case appears in a primary or kindergarten school the school should be closed within a week. But, as I have said before, it is perhaps a question whether the fact that they were excused from school would keep them very much more separated after they got home. Children mingle so closely at home and in city streets that perhaps a great deal of isolation would not be gained by excluding them from school, but certainly it might be tried, and something might be done to carry them along over those very susceptible years up to the age of five. If the cases were not diminished the mortality certainly would be, according to all the statistics.

DR. STACK. Are we allowed to permit children who have had the measles to go to school, according to the statutes of the Commonwealth?

VICE-PRESIDENT DURGIN. Measles is one of the diseases shut out by Act of the Legislature.

DR. CHASE. In Dr. Brough's excellent paper, and in the interesting remarks which have followed, there seems to be one omission. I would like to ask if Dr. Brough does not agree with me that, in view of the fact of the high mortality in measles among very young children, it would be wise to have day nurseries closed when there is an epidemic of measles in the neighborhood. The children in the nursery under six months of age would not be very susceptible, but there are a good many children over that age in the day nurseries who are very susceptible to measles. Would not closing of such nurseries, therefore, be a wise precaution?

DR. BROUGH. It would be a very good idea.

MR. NEWCOMB. Is n't there also another point in the matter? Measles seems to be a disease which many a good mother regards as one she is able to take care of herself, without a physician. There is a slight handicap about reporting. Is n't there another? I mean with regard to the law of 1907, which makes it mandatory on the part of the physicians to report. Would n't it be a good plan if our physicians reported a little more promptly, instead of letting quite a few cases go too long?

VICE-PRESIDENT DURGIN. In answer to Mr. Newcomb's question, I should say there can be no doubt about the propriety, and there is no doubt as to the demand upon physicians to report all infectious diseases of this type, that the parents or guardians should have quick notice of the fact, that the patient must be isolated and kept so until lawfully released, and also such instructions as may not have been given by the attending physician. I should say that the majority of cases of measles are not seen by a physician at all.

Are there any other remarks to be made? Dr. Shea, have you anything to say?

DR. SHEA. Mr. Chairman, Dr. Brough has covered the subject so well in the way our department is endeavoring to handle this question, that there is not much left to be said. I am a great believer in popular education. The conditions, if we go back fifteen or twenty years, existing as regards the handling of scarlet fever and diphtheria, give me great hope that we may be able to do something with this question. The mere fact that a case is isolated, and the mere fact that the patient is quarantined, is important. The placarding of the house in itself I think is a great help in handling this question of measles. You notify the public, and you notify the immediate neighborhood. It is going to take a long

time to see any results, but we have made a beginning. We are going to visit these cases, and if we find a child that is suffering with pneumonia, and that child is not receiving proper treatment, it is going to be sent to the hospital. I think hospital treatment is to have a great influence on the death rate in years to come, especially of this city. With the opening of the new measles pavilion in the fall at the South Department, and in addition fifty more beds that the Homœopathic Hospital will have at the Corey Hill hospital, we hope, in a few years, to show a diminished mortality for this disease. I think the great mortality in this disease, especially in the young, the children of one or two years of age, means neglect, means the lack of nursing and the lack of medical care.

As regards attendance at the schools, I think we have made a great advance. Heretofore, within a year or two, since the passage of the present law, whole families of children were excluded from school. If the youngest child in a family of seven or eight children came down with measles, the whole family was excluded from school, even when all the other children were protected by a previous attack. Now, when the case is investigated, the proper certificate is made by our local school inspector, and those other children are allowed to return to school. That in itself is a great advantage, if you consider the hundreds of days that are lost in the school year by different children in the city.

I have great hope that we are going to do something with this question of measles, and my faith is on the results that we have accomplished in scarlet fever and diphtheria. True, in diphtheria, we have had antitoxin as our great aid and strength, but scarlet fever is still showing and has shown good results as regards mortality. I think, as Dr. Brough has said, that this question must be met with, and the people must be educated, and the only people to educate the public are the health departments.

DR. VIETOR. Mr. President, I was hoping one of the speakers would allude to the fact that has been impressed upon me, that a large element in meeting this problem is the element of the lay mind, particularly the mind of the mother. There is a very general impression, among the mothers of the community, that measles is a disease of no import. A second impression, which is equally strong, is that it is of advantage to have the children all exposed to the disease and have the disease early, so as to have it over with. We have all had the personal experience of having mothers deliberately try to have their children take the infection. It occurs to me that a great deal could be done in a very simple way, by the health boards issuing a circular letter to the mothers and the teachers. I think they would be, next to the physicians, the great bodies of the people to meet. The mothers and the teachers have received their ideas from the physicians. The physician's standpoint has changed, or has become more enlightened. Now the question is, how to pass the new medical idea to the mothers and the teachers. It seems to me that a brief circular, embodying the conclusions expressed in the paper read here this afternoon, could readily be distributed directly by the health boards as a circular of information, and indirectly through the public press.

DR. ROSE. I would like to ask in what manner patients generally die from measles, that is, what intercurrent disease carries them off?

DR. BROUGH. Chiefly bronchial pneumonia. That is the most common cause assigned. There are a great many more deaths in Boston from measles than are actually reported, because many children that are suffering from measles die afterwards from bronchial pneumonia, and bronchial pneumonia is given as the principal cause of death, with, perhaps,

measles as the secondary cause. Such deaths often go into the records simply as deaths from bronchial pneumonia, and others are reported as bronchial pneumonia without giving the cause of death. So if we had actually in the State of Massachusetts all the deaths actually due to measles, they would be very much higher than they are at present.

PROFESSOR SEDGWICK. There is one point that I hope we shall not lose sight of, and that is that although the biology of this particular disease indicates that the germ, whatever it is, is of short life, biology shows that in other diseases the germs are sometimes of long life; so that while it is well, perhaps, to neglect disinfection for this short-lived germ disease, there are others, like typhoid, where disinfection has never yet been properly brought in. If we could give the energy now spent on disinfecting for measles to disinfecting for typhoid, which has a hardy germ, a germ which does live rather long in the environment, we should, I think, do well. It is rather an odd fact that we seem to be disinfecting for the wrong diseases. In the case of yellow fever, for example, we have given up all disinfection, and rightly, because we now understand better the method of transmission; but in the case of typhoid we have not yet begun to disinfect as thoroughly as we ought to, and to isolate the patient, or treat the patient as a contagious patient, as much as we ought to. So that if we have been laying the emphasis in the wrong place, the duty now upon us is evidently to put it in the right place.

DR. SHEA. I wish to say that our department sends a circular to the head of each family where measles has been reported. That is sent daily. In fact, as soon as the report of the case is received the circular is sent to the parent or the guardian of the child, with full directions about the care and isolation of the patient.

DR. BROUGH. In regard to the transmission of diseases by fomites, I have here a letter that is addressed to Dr. Durgin from Dr. A. H. Doty, who is the health officer of the port of New York. He states in part as follows:

> From my own experience and that of others who have also given this matter careful and practical consideration, I am satisfied that the clothing of well persons, baggage, cargoes, money, etc., transmit disease only in rare instances; that persons and not things constitute the ordinary medium of infection. I believe that mild, ambulant or irregular cases constitute one of the most dangerous factors in the transmission of infectious disease, because they are commonly overlooked and are responsible for outbreaks of disease, the origin of which is unknown, but are usually attributed to alleged infected clothing, etc. In making this statement I do not refer to the clothing actually worn by the sick.
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> It has been stated as an argument against this belief that the large increase in the number of cases of measles, scarlatina and diphtheria, which generally follow the opening of schools in the fall, is due principally to the transmission of these diseases by the clothing of well children in whose homes infectious disease exists or has existed. Some years ago the Department of Health of New York City established a school corps, consisting of physicians, who daily visit the public schools. Very soon after the beginning of their work indisputable evidence was presented to show that the increase in the number of cases referred to was due to the presence of children who were either desquamating from measles or scarlatina or were infected with these diseases, and also diphtheria in a mild or unrecognized form. These cases are now daily removed from schools.
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> These questions must be determined by practical experience and not by theory. Cases which on superficial investigation may appear to be trans-

mitted by clothing, etc., are upon exhaustive investigation commonly found to be caused by the presence of other cases.

The belief that disease is transmitted by persons and not things not only does not mean a relaxation in our efforts to protect the public health, but greatly increases the protection by demanding that an exhaustive inspection be made to detect the presence of cases responsible for outbreaks of disease.

VICE-PRESIDENT DURGIN. I would state that the letter just read is from a physician who was chief in the infectious disease division of the Health Department of New York for over twenty years.

The next paper on the program is on "The Function of Health Boards in the Control of Tuberculosis," by Dr. Edward O. Otis of Boston.

THE FUNCTION OF HEALTH BOARDS IN THE CONTROL OF TUBERCULOSIS

By EDWARD O. OTIS, M.D.
Boston

It is obviously impossible to suggest a course of action regarding the control of tuberculosis which is applicable, in all its details at least, to all boards of health. The conditions vary so greatly in different communities, depending upon the size of the community, a town, or a large or small city; the character and intelligence of the community; the power, means and equipment accorded the boards, and their freedom from political interference; and, finally, the character of the board itself as to skill, training and initiative. One can, therefore, only discuss the question upon broad principles and the application and modifications must be made according to local conditions.

The efficiency of any board of health must ultimately largely depend upon the intelligence and demands of the community which it serves. If the people want tuberculosis controlled, they will demand the creation of such a health board as will do it, or their share of it. On the other hand, the Board of Health must often take the initiative and show the people, by example and precept, the necessity of protecting themselves against this preventable disease, which is a menace to every member of the community. Education regarding the main facts of tuberculosis then falls within the legitimate province of the board, and often must be preliminary to more active measures.

The essential facts upon which must be based the control

of tuberculosis seem now to be at hand. We know the cause, the micro-organism which is always present, the methods of communication, principally through the sputum of a tuberculous individual; the conditions of personal and environmental hygiene which favor the development of the infecting germ, such as unwholesome and crowded living, the abuse of alcohol, unhealthy workshop conditions, etc. We know the stigmata which suggest an infection by the tubercle bacillus, the influence of family predisposition, and the effective means of destroying the bacillus.

In this State the local boards of health are greatly aided by the provisions of the State itself. Registration is obligatory, as in the acute contagious diseases; promiscuous spitting is unlawful; suspected sputum is examined free by the State Board; instruction upon the prevention of tuberculosis is required in the public schools; and the State inspectors, working under the State Board of Health, are supposed to aid the local boards in determining, at least in a general way, the prevalence of tuberculosis in their respective districts and in disseminating knowledge "as to the best methods of prevention."

The first and fundamental step in any attempt to control the disease is registration through notification by physicians and hospitals and by whatever other means knowledge of the existence of cases can be obtained and *where* they exist. When the case is once discovered, it should never pass out of the knowledge or supervision of the Board of Health until death occurs, removal to another city or town, or the case has been proved to have been arrested.

A street and house card index can be kept, indicating the locality of the cases, or this can be done by means of pins or dots upon a map. Thus it can be seen at once what localities, tenements or houses show excessive cases, and, consequently, especial control methods can be employed in these localities, tenements or houses.

If we are to effectually control tuberculosis in the congested districts of a city, something *more* must be done than simply to visit the reported cases. Whenever many and successive cases are found to exist in such sections, I believe the only thorough method to pursue is to make a house to house and tenement to tenement investigation, and cause, or urge to be examined, every inmate; which I believe can be effected by a tactful investigator, aided by the visiting and school nurses and the free dispensaries. At the same time the hygienic conditions of the tenements can be noted, which will yield the health board valuable information.

That such a suggestion is not chimerical, an investigation of this kind, now being successfully prosecuted in Wall Street at the North End of this city, under the auspices of the Boston Tuberculosis Association, proves. Similar street and house to house investigations have been made in Berlin and Paris, and, I dare say, other cities. I have only to refer to the recent striking "congestion" exhibition in New York City, where the relation of overcrowding in unhealthy tenements to tuberculosis was graphically shown. If we would control tuberculosis in the tenements, we must control the tenements and the conditions of life in them. It is absolutely essential, in my opinion, that, when once discovered, the dangerous consumptive should be constantly and always kept under observation, so that the dangers of infection, by removal from one tenement to another, may be avoided by prompt and efficient disinfection of the vacated abode before occupancy is again permitted, and that the other members of the family can be kept under observation.

Secondly, and as a necessary sequel to registration, are supervision and instruction of the consumptive at his home, unless the case is such that removal is required. This (supervision and instruction) can best be attained, in my opinion, by the visiting nurse rather than by an agent or inspector.

In small towns where there are not cases enough to occupy the entire time of such a nurse, it may be possible to make some arrangement with a private charitable association whereby a nurse can serve both agencies and so diminish the expense to both. In my experience, I find that the visiting nurse, if wisely selected, is able to gain the confidence of the consumptive and his family, and by patience, tact and repeated visits to keep him up to the demands of the tuberculosis hygiene.

It is understood that I have been referring to cases of tuberculosis as found among the poor and ignorant, whereas all cases should be reported. Those among the intelligent and better classes of the community can be left to the care and supervision of the conscientious physician.

It is, in my opinion, a very inadequate conception of the duty of the Board of Health to make a *single* visit only upon a consumptive, provided any visit at all is considered necessary. He should be kept under constant observation by repeated visits, as I have before said, and a record should be made of the conditions found on each visit. Incidentally the visiting nurse or agent should urge all the children or other members of the household to report to the dispensary, or to some reliable physician, for an examination of their lungs, for it is not an infrequent occurrence that other unsuspected cases have been discovered in the same household by this precaution.

Thirdly, disinfection on death, removal and at the time the case is first discovered of *all* portions of the house which have been occupied by the patient; and it would appear that the owner of the property should pay for such disinfection, and he could be made to do this by not permitting him to let the tenement again until it was done, as is the practice in certain health resorts.

It is hardly within the scope of this paper to consider the best and most effective methods of disinfection, but, in brief,

it may be said that the method which meets with general approval is a thorough fumigation with formaldehyde gas, followed by scrubbing the painted woodwork with a solution of hot soda and repainting, repapering, or recalcimining the walls. All hangings, bedding, mattresses, pillows and rugs to be disinfected with steam or exposed to the air and sunlight for several days, and all articles of little value to be burned.

Fourthly, another duty of the Board of Health is the removal and isolation of cases who cannot or will not conform to the regulations of the tuberculosis hygiene. Any Board of Health in this State, I believe, possesses full power to do this, tuberculosis being now legally a contagious disease, when, in their judgment or that of their agent, the case is a menace to the other members of the household. The difficulty has been, and still is, that there are inadequate facilities for isolating such cases. This difficulty will, however, be largely obviated in the future in this State by the three consumptive hospitals to be erected in different parts of the State for the reception of advanced cases. At present there are available the almshouse, a few private consumptive homes, or the special provisions made by some cities or towns, as in Brookline. In the report of the Relief Committee of the Committee on the Prevention of Tuberculosis of the New York Charity Organization Society the conclusion is reached that in New York City, and the same is applicable to the congested tenement-house portion of any city, relief in the homes of consumptives in a far advanced stage is a dangerous substitute for isolation in hospitals.

The problem of the control of tuberculosis, however, is only half solved when the reported cases are controlled and provided for; for it is a fact of common observation that only, as a rule, are the more or less advanced cases brought to the attention of the Board of Health. What of the earlier cases, those which have become "open," and which have tubercle bacilli bearing expectoration; and the still earlier

ones, the "closed" cases without such expectoration, but which will shortly become open if allowed to go on uncared for?

As Grancher truly says, an early diagnosis, a genuine early diagnosis, so important for the patient himself, is at least as important to the community at large, for, treated and arrested at this epoch, tuberculosis ceases to be contagious. To arrest the fire at its inception entails less loss and expense upon the community than attempts to control it when it is well under way.

The solution of this problem rests, in the first place, upon the medical profession; they must exercise greater eagerness, care and skill in making an early diagnosis, a diagnosis made in most cases before tubercle bacilli appear in the sputum, a diagnosis made from the general symptoms and auscultation, or, in doubtful cases, by the tuberculin test, a test now made easy and apparently fairly accurate by the ophthalmo-tuberculin method. In the second place, some provision should be made for the free examination of suspects, a free tuberculosis dispensary, either directly under the direction and support of the Board of Health or some other authoritative body. Many cities already do this, and every city should afford opportunity for a free, prompt and satisfactory diagnosis. A free tuberculosis clinic held one or more days a week, and at least one evening could, I believe, be instituted in any city or large town with comparatively slight expense, and by proper advertising the working people could be urged to present themselves for examination whether or not they think they have tuberculosis. One day, preferably Saturday, could be devoted to the examination of children.

In order to detect these early cases and put them under treatment before they become open and hence dangerous ones, and in order to discover other more advanced cases, who may never have realized that they are suffering from tuberculosis, free and ample facilities must be afforded the

poor and working classes for an authoritative examination in some such way as I have suggested. Of course this can be accomplished by private initiative under the auspices of tuberculosis associations, etc., but if not done in this way it seems to me to be a legitimate and necessary field for the Board of Health. In New York City the Health Department has its dispensary for this purpose; while in Boston this is done by the city, but under the direction of the Municipal Consumptive Hospital. The visiting nurse should attend the clinics and subsequently visit the homes of those found to be suffering from the disease. Free distribution of sputum receptacles, Japanese paper napkins, paper bags, etc., should also be made at the tuberculosis clinics and by the visiting nurse at the home.

In the medical inspection of schools a periodic examination of all the children would seem now to be in line with modern tuberculosis control work. If, as is now the case in some schools, an examination of the eyes, ears and teeth of school children is regarded as essential, equally so, it seems to me, is an examination of their lungs when one considers the prevalence and frequency of tuberculosis.

With regard to the conveyance of tuberculosis through milk containing bovine tubercle bacilli, it still remains to be proved that this occurs to any great extent, and up to the present time Koch's statement of 1901, made in London, that the dangers from bovine tuberculosis could be practically disregarded in the tuberculosis warfare has not been disproved. That the possibility exists, however, we know from proved facts, and hence some method of milk inspection and supervision, however it is done, is obligatory upon the Board of Health; of the methods of doing this it hardly falls within the province of this paper to discuss.

That, however, tuberculosis is frequently produced by food contaminated with tubercle bacilli seems certain, and many authorities, as we know, declare that the ingestion

form of infection is the principal one. Whatever opinion we may hold with regard to this, the method of prevention is one and the same, namely, the destruction of the sputum, cleanliness in the preparation of food, and the prohibition of promiscuous spitting. If we can control the tubercle bacilli sputum output, we can control and prevent the communication of tuberculosis, whether it is communicated by means of ingestion or by inspiration.

Finally, the education of the community. In some cities and towns this is done by private initiative, such as tuberculosis associations; in others, the Board of Health must undertake it and teach the public the simple facts of tuberculosis and its prevention. They must create a constituency who, by their intelligent conception of the problem, will cooperate with the board in its efforts to control the disease.

Such educational work is, in some States, carried on by the State Board of Health, either alone or in coöperation with the local boards. A notable example of this is the excellent and extensive work of the Illinois State Board, in its widely circulated and admirable tuberculosis literature. In other States a special tuberculosis commission takes charge of the educational work; while in others it is done by the local boards, or must be, if done at all.

The methods are familiar to you: tuberculosis exhibitions with lectures; lantern-slide lectures, particularly in schools; and the distribution of literature. Since in this State the law now requires that instruction upon tuberculosis and its prevention shall be given in the public schools, the boards of health might naturally be looked to to furnish material for such instruction.

In many States and almost all cities anti-spitting laws or ordinances exist, but in none, to my knowledge, are they, to any great extent, enforced. It is a very difficult thing to do it. Local boards of health can aid in the matter by cooperating with the executive department of the city, and by

instructing the people regarding the dangers of promiscuous spitting, by means of placards in public resorts, railroad stations, public vehicles, etc., and, when permitted by the owners, in factories, stores and workshops. In my opinion, cuspidors ought to be placed in all public places with the notice, "Spit here," placed over them. I believe nothing would do so much towards abating the promiscuous spitting nuisance as this step, for in this climate the average man will spit, and the solution of the problem is to make it possible for him to spit in safety to himself and others. At the same time it should be insisted upon that the cuspidors should be frequently and thoroughly cleaned and always kept partially filled with water or some disinfectant fluid.

However zealous, alert and skillful the Board of Health may be, they must have the coöperation of the medical profession and of the public if they are to be successful in the control of tuberculosis. The professional and moral support of the medical profession is most essential, for the physicians are the ones who influence and guide the public upon matters of health; only with their aid can the boards of health do their best work and obtain from the people their support, and, from the municipality, adequate appropriation, for the prevention of disease is expensive in the first cost, but it is as nothing in comparison with the ultimate economic gain.

The supreme test of any and all measures in the control of preventable disease is a steady decline in the death rate from these diseases; and when this does not occur it is an indictment of the authorities who have the health of the community in their keeping, provided they have an intelligent conception of their duties and are allowed a free hand in executing them. The notable diminution of tuberculosis in New York City, for example, within a comparatively few years, indicates that the Health Department of that city has successfully met this test with regard to this disease.

VICE-PRESIDENT DURGIN. This paper is now open for discussion.

DR. ROSE. Does the State Board of Health examine sputum sent in free?

VICE-PRESIDENT DURGIN. I will state, in answer to your question, that the Boston Board of Health, through its laboratory, examines all sputum sent in for examination. Perhaps Mr. Rickards can answer the question as to examination of the sputum, in a few words, better than I can.

MR. RICKARDS. I understand that the State makes examination of sputa free, for any city or town which has not a laboratory of its own; but a great many cities and towns now have laboratories. Boston makes the examination free, as do, to my knowledge, Brookline, Cambridge, Worcester, Springfield, Holyoke, Brockton, Somerville, Newton and probably some other cities and towns. Where the city or town does not make it free, then the State will make an examination for them..

DR. ROSE. Will you tell us how to proceed to get the examination made? How shall we send the sputum?

MR. RICKARDS. The State has an outfit which you can obtain. Usually they have some station within the city or town, but if they have not you can get it from the State Board of Health Laboratory.

VICE-PRESIDENT DURGIN. In Boston there are forty-nine places in which such city outfits are placed for the accommodation of physicians.

The question is still open for discussion. If there is nothing further to be said upon this important and interesting paper, we will pass to the next subject for consideration, the report of the Committee on Sex Hygiene.

DR. PALMER. In behalf of the committee appointed at the last meeting of this Association, I wish to say by way of preface that we realize fully the very great difficulty and importance of the work that was placed upon us. We also have fully realized the delicacy of the question, and how it can best be handled, but we have also realized that it was time that something definite was done, and that some work was infinitely better than no work. We feel, too, that the question can be largely and perhaps best approached from the side of public instruction. I would further say that we have given the subject a great deal of time and thought and hard work, and I present to you, for the committee, this report.

Report of the Committee on Sex Hygiene to the Massachusetts Association of Boards of Health

Mr. President and Fellow Members: In view of the facts that syphilis and gonorrhœa are highly contagious and therefore preventable diseases; that they are dangerous to the public health and welfare; that a large percentage of the people at some time contract these diseases; that they make men and women sterile; that they fill wards of hospitals and the homes of the people with chronic invalids; that they deny to the child its fundamental right to be well born; that one of these diseases causes a large part of that terrible affliction, blindness; that much of this great evil is due to ignorance and support of ignorance by the foolish and prudish notion that the enlightenment of the public as to sex hygiene is improper, unwise and unsafe, your committee unanimously makes the following recommendations:

1. That this Association request the State Board of Health to include syphilis and gonorrhœa in the list of diseases dangerous to the public health, and that physicians and householders be required (as in the case of any other

notifiable disease) to report cases of syphilis and gonorrhœa to the local board of health with the privilege, if desired, of giving only the initials, the address and apparent age of the patient. The initials are important to prevent the registration of the same case more than once. The object is that the Board may have some knowledge of the extent of the problem and may send to the physician for the patient a circular of information about these diseases and means of controlling them and preventing their becoming an even greater menace to public health.

2. That this Association request that the State Board of Health send to all local boards of health for distribution, by physicians and hospital superintendents, to persons having syphilis or gonorrhœa, a printed leaflet or card similar to that herewith presented setting forth the source, nature and means of control of these diseases.

3. That this Association request the State Board of Registration in Medicine to include prevention and cure of syphilis and gonorrhœa among the subjects of its examinations.

4. That this Association request that free bacteriological examinations be made in all board of health laboratories of smears from the eyes of infants suspected of having gonorrhœal ophthalmia and from genito-urinary organs of persons believed to be suffering from or cured of gonorrhœa.*

5. That this Association request that every general hospital make provision for admitting cases of both of these diseases to its wards.

6. That this Association urge upon the school authorities judicious instruction of grammar, high-school and college students in sex hygiene.

If these recommendations are approved by this Association, we suggest that the committee be continued until the next

* Such examinations are now made free by the Bacteriological Laboratories of the Boston, Cambridge, Brookline and Somerville Boards of Health.—*Ed.*

annual meeting. To further these and other objects within its scope and to enable the committee to print and distribute, through proper channels, educational circulars on sex hygiene, we ask that a suitable appropriation be made.

Respectfully submitted,

LEWIS N. PALMER, M.D., *Chairman*
H. LINCOLN CHASE, M.D.,
GARDINER T. SWARTS, M.D.,
WALTER E. KRUESI, B.S., *Secretary,*
Committee on Sex Hygiene.

I would say, Mr. President, that I have here some circulars of information, such as seem to your committee to be wise.* If there is any desire to hear them I will read them, but to save time it perhaps will not be wise to read them. I want further to say that we have made several recommendations, hoping to get the approval, or at least the coöperation, of the State Board to give this work a proper standing. There are now many societies working along this line from different standpoints and approaches. I think if this Association, backed by the State Board of Health, will give this subject a proper backing, very much can be done. We are not dealing with a new subject. Something like half a dozen States have already taken action on this subject, and have distributed circulars similar to the ones that we have prepared.

VICE-PRESIDENT DURGIN. Gentlemen, this important report of the committee is before you. What is your pleasure?

PROFESSOR SEDGWICK. Mr. President, I was unfortunately absent from the meeting when this subject was taken up, so that it comes to me about at this time as an

* These circulars will be printed in full in a later issue.—*Ed.*

almost entirely new matter, but I should be sorry to see it go through without having given to it my commendation and assent, because I feel strongly that it is a matter of grave importance to the public health and to the public welfare. I have heard with interest of the work of the committee, and have looked over their report with some care, as well as over the draft of one or more of the circulars which they have prepared. While these latter, perhaps, deserve still further consideration, because when we move we want to be sure that we are moving exactly right in every way and with every statement put as strongly and yet as quietly as it can be, I do feel that the committee has done excellent work, and that it is our duty, as a public health association, to take up the work along the lines that they have indicated. It is, I suppose, obvious that State and local boards of health will always find it difficult to make the complete and original movement in matters of this kind, because they represent all branches of members of the community, and there is naturally a difference of opinion as to the wisdom of attacking a subject of this kind. For my own part, I cannot see that any such objection, however valid when applied to official boards of health, is valid when applied to an association like this, and I do believe that the time has come when this Association should accept the duty of leadership in this matter in this State, and when it should take up the subject and put itself on record as believing that the time has come to do something about it. This is a case where ignorance is not bliss, and it seems to me that the corollary also follows, that, therefore, it is not folly to be wise. It does seem to me that, not only through boards of health and their official representatives, such as we have here, but through persons interested in public health and sanitation and through schools, work ought to be done and information disseminated. Any one who has attacked, for example, the school end of the proposition knows how difficult a matter it is. A schoolbook which

should deal with these matters frankly and in a dignified way would still meet today with very little acceptance. It is a difficulty which comes before every writer of school text-books. But the time will come when there will be information of the kind in the leading and best text-books for school use, and that time will be hastened if associations like this put themselves on record in favor of the movement. I don't know what step ought to be taken in order to give efficacy to the action of this committee, which has been so ably presented in its report, by the chairman. But I see at the end of the report the statement, that if these recommendations are approved by this Association the committee suggest that they be continued, at least until the next annual meeting. And that to further these and other objects within its scope, and to enable the committee to print and distribute through proper channels educational circulars on sex hygiene, they ask that a suitable appropriation be made. If, then, Mr. Chairman, it is in order, I should like to move, first, that this report be accepted and adopted; and, secondly, that the committee be requested to continue in its work until the next annual meeting at least; and, thirdly, that an appropriation be made to enable them to carry on their work.

The motion was seconded.

VICE-PRESIDENT DURGIN. It is moved and seconded that the report of the committee be accepted and adopted, and that said committee be requested to continue its work until some future meeting. Is there anything to be said upon this motion?

The motion was adopted.

VICE-PRESIDENT DURGIN. I would like to ask for a vote of thanks to our visitor, Dr. Otis, for his able and interesting paper on tuberculosis.

The motion was adopted unanimously.

DR. CHASE. In regard to an appropriation for the carrying out of this work, there will be some expense for printing, typewriting, stationery and postage. I would like to make a motion that, after reference to the Executive Committee, if that be necessary before an appropriation of money can be made, such sum may be appropriated as may seem wise to the Executive Committee in conference with the Committee on Sex Hygiene. Is that motion in order, Mr. Chairman?

VICE-PRESIDENT DURGIN. I have not a copy of the Constitution and By-Laws before me, but my impression is that those appropriations have to be made by the Executive Committee.

MR. COFFEY. Mr. Chairman, the Committee on Scientific Papers have charge of that. That committee consists of the First Vice-President and two other active members.

DR. CHASE. Then, of course, that answers my question, Mr. Chairman.

VICE-PRESIDENT DURGIN. I see no harm in taking the expression of the Association upon that question. How much of an appropriation is needed?

DR. CHASE. We think that about $250 will be necessary. We intend to expend the money within the State, and not send circulars outside the State in any quantity. Samples may be sent.

VICE-PRESIDENT DURGIN. The motion is made and seconded that the proper committee —

PROFESSOR SEDGWICK. May I say, subject to the approval of the Executive Committee?

VICE-PRESIDENT DURGIN. It would be a recommendation from the Association. The motion is made and seconded that the Association recommends an appropriation of $250 to be expended by the Committee on Sex Hygiene. Those in favor of this motion —

DR. PALMER. Before that motion is put I would like to have the members understand the situation. Some of them may wonder if we have got any money to do it with. I will say that we took the trouble to look up the last report of the Treasurer, and we found that there is something like $1,500 in the treasury, so that we have the money to use if it is so voted.

The motion was adopted.

VICE-PRESIDENT DURGIN. The next business is the proposed amendment to the Constitution, changing the present name of the society to The Massachusetts Public Health Association. Is there anything to be said upon the proposed amendment?

MR. COFFEY. Mr. Chairman, when this matter was first proposed I had not given it much attention, and consequently it made very little impression upon me, but the more I have thought of it since, the more deeply I have become impressed with the idea and the conviction that we had better let well enough alone. The present name of the Association conveys clearly and distinctly the objects and purposes of the Association. It tells what it is, without any explanation whatever; it is an association of the boards of health of the State. The purpose of the organization at its inception was to bring together the members of the various boards of health throughout the State for mutual intercourse and discussion. There has been no desire on the part of the members of the various boards to exclude persons who are interested in sanitary

matters from the Association; on the contrary, the reverse has been true, and we have been only too glad to have any and all who are interested in the subject join the Association; and the very fact, too, that some of the best men and women of the State, interested in such subjects, have joined the Association, shows pretty conclusively that the name has had no deterrent effect in preventing the Association from growing and from carrying out the purposes for which it was designed when it was started.

I have the honor of having started this Association. My desire and purpose was to get together, as I said at the start, the members of the various boards of health, particularly those of the smaller cities and towns of the State, and because too it came to me very strongly early in the beginning of my work when I found it necessary a great many times to go to the Boston Board of Health and get, from their greater experience and greater knowledge, information that I needed. And I want to say here and now that they never failed me, they were always ready and willing to give me that information. In that way the thought struck me that it would be a good thing if the various boards of health could get together, and the Association was formed. At my request a notice was sent out by the Chairman of our Board in Worcester, and the first meeting was held a short time subsequently. Our object was to get into this organization members of boards of health, from the smaller cities and towns of the State particularly, and from the older cities and larger cities to get the benefit of their larger and wider experience, and I think the growth and the success of the Association have shown that the name, as I said once before, has had no deterrent effect. We have grown. When a new member of a board of health has been appointed in some small city or town, and he has been asked by his associate to join the Association, and he has replied, "What is it?" and he has been told, "It is the association of the boards of health of the State," there has been no other

explanation needed. He joins, if he has any desire at all. But if you should say, "It is the Massachusetts Public Health Association," you have got to explain what the Massachusetts Public Health Association is. You don't need to explain the other; it explains itself. I have no objection to calling the magazine what you may see fit to call it, but I think the present name more clearly defines and expresses what this Association is when the title, The Massachusetts Association of Boards of Health, is given, than the proposed title, The Massachusetts Public Health Association.

MR. RICKARDS. I desire to state that while I have had nothing whatever to do with the introduction of this motion, except, at the request of the President and, purely as a matter of form, to put it before the Association in a constitutional way, after thinking the matter over I am in favor of the change. The new name is certainly a little less of a mouthful than the old one. If any of you have had occasion to use the old name as many times as I have, and perhaps over the telephone, you will find it is rather an awkward thing to say. There is another argument for the new name, and that is that it brings it in line with the national organization, the American Public Health Association. The local associations sooner or later should have a closer affiliation with the national organization. This Association, together with the various schools for health officers and other associations of like character, may in the future, perhaps, be associated with the national organization for effective work, and it seems to me that this name would be a start in the right direction.

VICE-PRESIDENT DURGIN. Are you ready for the question? Those in favor of the proposed amendment will say aye, contrary minded no.

A *viva voce* vote was taken.

VICE-PRESIDENT DURGIN. The Chair is inclined to think the ayes have it. Being in doubt we had better have a count.

A hand vote resulted, 16 yes, 20 no.

VICE-PRESIDENT DURGIN. Sixteen for and twenty against, and the amendment is lost.

Is there any other business to come before the meeting?

DR. ROSE. The question as to how to get sputum tested for tuberculosis bacilli at the State House has been answered in the following note:

May I offer the information that a mail or personal request to the State Board of Health, State House, Boston, will result in your being sent as many sputum boxes as you desire? When you return these to the Board they will make a prompt examination of the sample, and send you a sealed report as to the finding. WALTER E. KRUESI.

VICE-PRESIDENT DURGIN. Is there any other business to come before the meeting? If not, a motion to adjourn will be in order.

On motion, the meeting adjourned.

PERSONAL HYGIENE

By PERCY G. STILES, Ph.D.
Instructor in Physiology, Massachusetts Institute of Technology

THE USEFULNESS OF CARBON DIOXIDE. We have recently called attention to the unexpected value of muscular waste products as stimulants. Since Dr. Lee published his interesting results, further observations of a related kind have been reported by Dr. Henderson of the Yale Medical School.* Carbon dioxide is the chief oxidation product of animal metabolism. An average quantity of 800 grams is excreted daily through the lungs of a man. It has always been natural to regard this gas as something which the organism seeks to get rid of, and to assume that the more freely it is discharged the better will be the condition of the tissues. But the remarkably large quantity in the arterial blood has always had to be reckoned with. The usual amount is not far from 40 c.c. CO_2 in 100 c.c. of blood. It has gradually come to be recognized that it is as bad to lower the percentage of carbon dioxide in the blood as it is to raise it. Mosso, the Italian physiologist, has noted this, and has given the name of "Acapnia" to the condition of lowered carbon dioxide content. The word means, literally, "smokelessness." It can be produced in a certain degree by voluntarily deepening the respiration, but the tendency to desist from the attempt soon becomes overpowering. A state of apnœa (suspended breathing) tends to ensue, and so the normal relation between the gases in the blood is re-established. Haldane has shown how very sensitive the

* American Journal of Physiology, 1908, Vol. XXI, p. 126.

respiratory center is to changes in the carbon dioxide content of the blood.

Dr. Henderson's studies have especial relation to the question of surgical shock. This is a threatening condition of collapse in which the weak, rapid heart and insufficient circulation are the obvious features. It has been natural to refer it to nervous causes. In the light of the latest observations it appears to have a simple chemical origin in acapnia. The characteristics of shock are readily produced by artificial respiration in dogs and can be counteracted by restricting the air supply. Thus the very measures which might be expected to give relief seem calculated to make matters worse. Acapnia may be produced during anæsthesia by the deep breathing which goes on while the general metabolism is at a low level, and if the tissues are freely exposed in an operation we have an additional channel by which carbon dioxide will escape. This last factor may be more important than would appear at first, for we must remember that while in the lungs we have the blood in the presence of alveolar air containing about five per cent of CO_2, the blood in the surface vessels of an exposed organ is in contact with the atmospheric air with no such back pressure of the gas.

The author refers to the acute inferences of Mosso in regard to a possible connection between acapnia and "mountain sickness." Such a connection is made to appear more probable by Dr. Henderson's experiments. In rarefied air there is difficulty in getting the required amount of oxygen and deepened breathing is necessary. There is no corresponding difficulty in discharging carbon dioxide, which passes off at least as freely as at the sea level. Under such conditions acapnia must be produced and the pressing need for oxygen forbids the apnœa which would naturally follow. Various disturbances may come from this abnormal composition of the blood, the quick, inefficient heart-beat being prominent here as in shock. It is said that surgical shock

is more frequent at high altitudes, in Colorado for instance, than elsewhere.

Physiologists have long since observed that carbon dioxide is stimulating to the intestinal wall, improving its tone and promoting peristalsis. Its action on the blood vessels is probably similar. Its effect on the heart is less simple, for it seems to favor diastole and systole in turn, while in its relative absence (acapnia) the heart relaxes incompletely and is rendered ineffective more by this fault than by any failure to contract. It remains to be seen how far the effects are direct and how far they are brought about through the nerve centers. Dr. Henderson has done well to open our eyes to the vital value of a compound which we regard as a typical waste product, and the additional papers which he promises will be anticipated with much curiosity.

MUNICIPAL SANITATION

By CHARLES V. CHAPIN, M.D.
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CONTROL OF THE MILK SUPPLY. The English cities of Liverpool and Manchester are doing much to improve their milk supplies. Among other things frequent tests are made of milk to determine the presence of tubercle bacilli, and for this purpose inoculation tests are made upon guinea pigs. In Liverpool * 209 samples from dairies in the city were taken, and of these 3 showed the presence of the bacilli, while of 321 samples of country milk, 22 were infected. Great effort has been made to free the city dairies from tuberculous cows, and the result is shown by the difference between the city and country milk. In Manchester† the milk from 542 farms was tested for tubercle bacilli by inoculating guinea pigs, and 42 samples, or 7.7 per cent, were found to be infected.

The city of Plainfield and town of Montclair, N.J., always issue interesting health reports. Both communities make great effort to maintain their milk supplies at a high standard. One method of accomplishing this, and at the same time educating the consumers as well as the producers, is by publishing the averages of the analyses of milk from all the dealers supplying the city. This of course would not be practicable in a large community, but would seem to be a very useful procedure in small cities or towns. Not only are the average fats, solids and bacteria given, but each farm is

* Report on the Health of the City of Liverpool, 1906, p. 189.
† Report on the Health of the City of Manchester, 1906, p. 187.

visited and rated according to the standard score card used by the United States Department of Agriculture, and the results of this scoring also are published.

ISOLATION HOSPITALS. Attention has previously been called to the successful working of the Pasteur Hospital in Paris, where different contagious diseases are treated by the same nurse in cubicles opening into a common corridor. The idea that aerial infection can be ignored, and that contact infection can be avoided by scrupulous care on the part of attendants, seems to be gaining ground. About a year ago a hospital on this plan was erected at Walthamstow, England,* and has been in successful operation ever since. It is true these cubicles do not open into a common corridor, but on to a veranda. Different diseases are, however, cared for by the same nurse. The old London Fever Hospital is about to erect a pavilion on exactly the plan of the Pasteur Hospital. At the Southwestern Hospital, in London, the separation of patients is even less than in the hospitals just mentioned. The partitions between the beds extend only seven feet above the floor, falling considerably short of the ceiling. Dwarf doors about three feet high are provided, opening into a central corridor.

The belief that the desquamation of scarlet fever is not infectious also seems to be gaining ground. At Manchester, England,† during 1906 scarlet-fever patients were discharged from the hospital at the end of four weeks without reference to desquamation, provided there was no nasal or aural discharge or other complications. The average time spent in the hospital was thus reduced about two weeks. There were no bad results from the discharge of desquamating patients.

While it is useless to expect that isolation hospitals will

* Public Health, April, 1908, p. 72.

† Report on the Health of the City of Manchester, 1906, p. 257.

ever exterminate the contagious diseases, yet there is no doubt that their use accomplishes a great deal of good. It is interesting to note just how much can be accomplished in the way of preventing extension of the disease in the family by removing cases to the hospital. Dr. Malet of Wolverhampton * states that during eight years, of 4,864 susceptible children remaining at home after a scarlet-fever case had been removed to the hospital, 4.8 per cent contracted scarlet fever; while of 468 susceptible children in houses where the patient was treated at home, 28.2 per cent contracted the disease. These figures are more favorable than those from Providence,† where the attack rate is only diminished about one-half by the removal of the patient to the hospital.

FLIES AND DISEASE. Professor Delepine‡ is continuing his experiments in regard to the relation between flies and the spread of disease. Flytraps are maintained at a dozen or more different places scattered over the city, and the number of flies caught each week is noted. There appears to be little relation between the prevalence of typhoid fever and an abundance of flies. This may possibly be due to the fact that there is very little typhoid fever in Manchester, and hence little infective material to be carried by the flies. Dr. Niven, the medical officer of health, thinks that a good deal of the Manchester typhoid is due to eating contaminated shellfish, and he determined, in 1906, that 36.8 per cent was due to contact infection, that is, was traced to previous cases. It is believed in Manchester that there is a relationship between infantile diarrhœa and flies. An increase of diarrhœa follows an increase of flies by three or four days. In 1905 the maximum fly time was in the first part of September, and the maximum deaths from diarrhœa immediately followed. In

* Public Health, April, 1908, p. 72.
† Report of the Superintendent of Health, 1903, p. 27.
‡ Report on the Health of the City of Manchester, 1906, p. 82.

1906 the maximum for flies was August 5, immediately followed by the maximum for diarrhœa. Thirty-five collections of flies were tested by Professor Delepine and coli bacilli were recovered from 4. The method of collecting and examining the flies is described. At the administration building of the hospital 300 flies marked with white enamel on the back were liberated, and within five days 4 of them were caught in neighboring wards, distant from 30 to 190 yards.

INACCURACY OF THE CLINICAL DIAGNOSIS OF DIPHTHERIA. It will be remembered that Hill, by a somewhat elaborate calculation based on cultures examined at the bacteriological laboratory in Boston, arrived at the conclusion that the margin of error in the ordinary clinical diagnosis of diphtheria is about 50 per cent. It is worthy of note that of 162 cases sent to the hospital in Walthamstow, England,* 79 proved not to be diphtheria, making the error in diagnosis 48 per cent. It is surprising to learn how little use is made of cultures for diagnosis in many English cities. Thus in Newcastle† there were 288 reported cases of diphtheria, but only 179 cultures were examined, of which 87 were from contacts in a public institution.

* Report of the Medical Officer of Health, 1905, p. 35.
† Report of the Medical Officer of Health, Newcastle-upon-Tyne, 1905, p. 6.

SANITARY ENGINEERING NOTES

By ROBERT SPURR WESTON
Assoc. M. Am. Soc. C. E.

NOVELTIES IN FILTRATION AND THEIR THEORY.* An interesting and thorough account of recent developments on the European Continent and of the author's experience with preliminary filtration as an auxiliary to water purification.

The delayed development of water purification in France has been due, in part, to the opposition of hygienists, who objected to water filters on theoretical grounds and in the face of evidences of their efficiency. These objections have caused the French engineers to improve their purification devices in order to force their recognition by the hygienists. In 1900, M. Puech, a French cloth manufacturer, published an account of his system. A typical plant at Suresnes consists of successive filters of gravel, the size of the gravel and the rate of filtration diminishing with each successive filter, the rates being 225, 130, 75 and 45 million gallons per acre per diem respectively, and the effluent being discharged upon two sand filters operating at the rates of 15 and 2.5 million gallons per acre per day, respectively. The water treated is very muddy, yet at the worst times the effluent from the gravel filters is scarcely opalescent, while the effluent from the last sand filter contains fewer bacteria than the "pure" spring water supply of the city.

Kemna experimented at Antwerp with a gravel strainer which he used as a roughing filter for an ordinary sand filter.

* Ad Kemna, Eng. News, 59, 328.

The gravel filter was divided into three successive compartments and operated at the rates of 80, 80 and 40 million gallons per acre per day, respectively. Mixed gravel was used at first. It clogged rapidly and was replaced with graded gravel which worked satisfactorily. There was a marked retention of suspended particles, even of very small size, and also a chemical action on the organic matter, free ammonia being produced to a remarkable degree.

The action of the gravel is a physical one. The particles are removed by adhesion, that is, by attraction, consequently the finest particles are easiest removed. Their retention is a question of multiplicity of contacts largely independent of speed. There is probably some bacterial action also, as in a trickling sewage filter. The time of contact with gravel was less than fifteen minutes. Gravel roughing filters are easily cleaned, relieving sand filters of much work. Their advisability must be determined by their cost when compared with that of a subsiding basin of like efficiency. It is believed that sand in a sand filter acts to retain bacteria just as the gravel acts to retain suspended matter. Preliminary filtration has been used at Zurich many years. The filter consists of 12 inches of coarse sand and 24 inches of gravel, and the rate of filtration is about 50 million gallons per acre per day. Mechanical filters as preliminary filters, and the cleaning of slow sand filters by suction dredges without treating of the water, are mentioned. The writer also describes a new porous under-drain made of 3-inch slabs of gravel concrete with a minimum of cement. Their use must be limited however.

At the St. Maur filtering station at Paris, experiments are being made upon the sterilization of filtered water. Two systems of ozone treatment and the Duyk Ferrochlor system are being tried. They are a commentary upon the high standards of the French hygienists. The impracticability of Miquel's method of counting bacteria, which requires fifteen

days, is brought to notice, and the usefulness of his test for *B. coli*, which requires but twenty-four hours, is commended. The author criticises the finical rules of the French hygienists, which require a filter effluent in which *B. coli* is found to be run to waste for five days. The simple presence of *B. coli* is not so important as the number of these organisms present.

In general the author thinks that the attempts of the French engineers to comply with the high standards of the hygienists have resulted in improvements, even if they disregard the advances made in other countries.

CHEMICAL PRECIPITATION OF WATER AT ST. LOUIS, MO.* Two articles on the water purifying system of the city of St. Louis have been reviewed in this journal. This article is an abstract of a paper recently presented before the American Society of Civil Engineers, by E. E. Wall, C.E., Assistant Water Commissioner of St. Louis, which describes some new apparatus devised to handle the coagulant used to purify the water and also gives more recent operation statistics. The vast quantity of water handled has made it judicious to add varying amounts of dry quicklime and dry ferrous sulphate to tanks of water through which the current flows uniformly and constantly. To reduce the loss of lime due to insufficient hydration, the heat produced by slaking the lime is used to make the milk of lime.

The cost of treatment has been as follows:

1904–5	$3.60
1905–6	3.99
1906–7	4.62

On an average during 1906–7, 2.13 grains of ferrous sulphate and 7.39 grains of lime were added to each gallon of raw water. The new plant is being designed to handle the coagu-

* Eng. News, 59, 188.

lant more cheaply. The cost of operation of this part of the plant is estimated at $17,000 a year for seventy-five million gallons daily. The results show a slightly turbid water, which at most times possesses a caustic alkalinity. The author believes that it is pure and wholesome. He makes no mention of the tendency toward a deposit of calcium and magnesium carbonates in the distribution system, especially in the water meters.

A NOTABLE GROUND WATER DEVELOPMENT AT PUEBLO, COLO.* Owing to the polluted character of the Arkansas River, a new supply was needed for the city of Pueblo. The topography of the country, the nature of the formation in the valley of the Fountain River, which flows into the Arkansas River, is such that there is a remarkable underground supply beneath the river bed, apparently independent of the surface flow, having its source in the almost perennial snow of the Pike's Peak district, with adequate quantity besides. Galleries arranged herringbone fashion were driven beneath the river bed at a point fourteen miles from the city; they delivered water into a well from which a conduit takes the water to two reservoirs on a hill near the city.

Following the description of the nature and character of this interesting supply is a detailed account of the construction of the system is given, including the method of making concrete pipe on the work and the difficulties encountered in laying it below the ground water level.

SANITARY INVESTIGATION OF THE MOHAWK RIVER DRAINAGE AREA.† A review of the report of the New York State Department of Health on the condition of the Mohawk River shows that there is considerable pollu-

* Eng. Record, 57, 399.
† Eng. News, 59, 376.

tion of that stream from municipal outfall sewers and by factory wastes, troublesome especially in dry weather. Using the power vested in it by the Act of 1903, the Health Department has approved only those plans for sewerage systems which make provision for sewage disposal works. It has investigated the matter of villages violating public health laws, and has advised all communities to use only filtered water; but it has been handicapped in achieving the best results because the flow from existing outfall sewers is beyond its prohibition.

STUDY OF THE ECONOMIC COSTS OF TYPHOID FEVER IN TWO WARDS OF PITTSBURG, PA.* An abstract with statistical appendix of a report by Mr. Frank E. Wing of a study of 194 cases of typhoid fever at Pittsburg. There were 11 deaths and 183 recoveries. The actual loss in wages was estimated at $12,459, but this cost was augmented by the cost of caring for the patients in hospitals and homes, also by the cost of funerals. The total cost aggregated $24,345, the same being the cost of less than half the cases of typhoid fever in two wards during one year. There were 5,637 cases in the whole city during the same year. Typhoid has prevailed at Pittsburg for twenty-five years, and its annual cost to the community on the above basis would amount to several hundred thousand dollars. Beside the money loss is the loss of health which often follows typhoid fever, and the effect upon the comfort and strength of the patient, which the disease imposes. The study clearly indicates the drainage of the vital forces of the community which typhoid fever causes.

PROPOSED NATIONAL PUBLIC HEALTH AND WATER SUPPLY AND SEWERAGE INVESTIGATIONS.† A bill introduced in the House of Representatives on March

* Eng. News, 59, 252.
† Eng. News, 59, 373.

6, by Mr. Hepburn of Iowa, would enlarge the powers and duties of the United States Public Health and Marine-Hospital Service, authorizing it to make special investigations of tuberculosis, typhoid fever and other diseases, and of water purification and sewerage disposal with particular reference to stream pollution. Provision is made for the establishment of a school of hygiene open to State, county and municipal health officers and for increasing the number of conferences between the United States Public Health and Marine-Hospital Service and the public health authorities of the several States. The duties and compensation of the Advisory Board of the Hygienic Laboratory are also increased. A sanitary engineer would be appointed to take charge of the technical matters connected with water supply and sewerage.

The bill provides for the substantial enlargement of the present scope of the United States Public Health and Marine-Hospital Service, but that part relating to stream pollution would seem on its face to be a duplication of the work now being done most efficiently by the hydrographic department of the United States Geologic Survey.

TYPHOID FEVER EPIDEMIC AT WATERTOWN, N.Y., IN 1904.* From 1885 to 1903 typhoid fever was responsible for 4.17 per cent of all deaths in Watertown. In 1904 the total death rate was 12.81 per cent. While the cause of the prevalence of this disease was attributed to the water supply, the town was very slow in making an investigation into the causes. In 1904, at the height of the epidemic, the situation became urgent and Dr. Soper was placed in charge of the sanitation of the city. He adopted stringent measures to stop the epidemic, urging special care of the sick, supplying disinfectants free, and distributing spring water at a cost of only one cent a gallon, and hastening the construction of the filter plant.

* Abstract of paper by Dr. G. A. Soper, Eng. News, 59, 315.

A special bacteriological laboratory was installed at the city's expense, and all houses in which patients had been ill were thoroughly fumigated. The measures adopted proved effective. A filter plant designed by Allen Hazen, C.E., was pushed to completion and the typhoid-fever death rate was greatly reduced.

THE FUTILITY OF RULES FOR THE PROTECTION OF SURFACE-WATER SUPPLIES IN NEW YORK STATE.* Futility of the rules, in themselves stringent and theoretically legally effective, is shown in the case of the Watertown typhoid-fever epidemic of 1904 and in the recent experience at Peekskill, N.Y.

There are two difficulties in the way of enforcing the rules:

1. The expense of excluding pollution is incumbent upon the water authorities alone, while the offending person, corporation or municipality goes scot free.

2. The necessary sanitary control of the surface supply covers such an extent of territory that only large cities can afford it. Both of these difficulties have resulted in the unpardonable neglect of ordinary sanitary precautions, and revision of the law should be made, providing, among other things, that the State rather than the local authorities have control of those large drainage areas from which water supplies are drawn.

WATER SUPPLY AND TYPHOID FEVER AT WASHINGTON, D.C.† A symposium on typhoid fever was held by the Medical Society of the District of Columbia. The papers read practically removed the suspicion cast on the slow sand filters, because the typhoid fever was not being reduced as expected. Dr. Magruder, in his introduction,

* Editorial in Eng. News, 59, 343.
† Eng. News, 59, 222.

said that it would be possible to reduce disease by additional authority to the District Commissioners for the regulation of dairy products, — milk, cream, ice cream and butter, — a bacteriological laboratory and more inspectors for the Health Department. Major Crosby stated that a period of seven to ten days elapsed before the water of the Potomac River passing the last important source of pollution reached the consumer. In regard to the discussion of using sedimentation or coagulation before filtering, he said that the former had reduced the turbidity by 63 per cent, and the bacterial count by 87 per cent. Dr. Longley upheld the latter method. The Typhoid Board accounted for approximately 30 per cent of the typhoid cases in 1906, and 50 per cent in 1907, the chief causes being milk, contacts and importation. Dr. Wiley discussed the dangers of domestic filters, water-coolers and ice cream, the last being severly censured.

Further papers were given on Dairy Farm Inspection, on Dangers from Infection and Dangers due to Chronic Typhoid Bacillus Carriers. A few interesting statistical tables are appended.

MORE LIGHT ON THE WASHINGTON TYPHOID AND WATER-SUPPLY PROBLEMS.* Comment is made on the way in which the filters, the only scientifically designed barrier to the spread of typhoid in that city, were condemned when the other sanitary conditions were so deplorable. Inferences are drawn from the per cents of the cases studied and known about, pointing to more effective inspection in 1907. The whole case shows the need for thorough investigation everywhere of each typhoid case. Some members of the Medical Society are scored for preferring sedimentation to coagulation in view of the conditions existing at Washington.

* Editorial in Eng. News, 59, 226.

THE DEVELOPMENT OF THE MECHANICAL FILTER PLANT.* This is a review of an excellent paper read by Mr. Philip Burgess at a meeting of the Ohio Engineering Society at Columbus.

After a brief history of mechanical filtration, noting the improvement in design and in the materials of construction, as well as the automatic devices for operation, the paper gives a systematic account of the evolution of various parts of this type of filtration plant, namely, filter tanks, strainer systems, arrangement of wash-water troughs, agitation, filtering material, coagulation and coagulants, also an account of improvements in auxiliary machinery and clear water reservoirs.

HIGH RELATIVE RATES OF FILTRATION WITH SLOW SAND FILTERS.† Slow sand filters are now designed to operate at rates of 2.5 to 3 million gallons per acre per diem, although experimental evidence has shown that higher rates are practicable. These low rates are necessary where filters have to be drained and scraped by hand, because the scraping process requires twelve hours and high rates would make necessary larger reserve areas. With higher rates, finer sand could be used. Author has tested Blaisdell's filter sand washing machine, which cleans the sand without disturbing the water above the filter and without keeping the filter out of service for more than an hour or so. The work can be done with one or two men at any hour of the day or night. The machine permits higher rates, even as high as ten million gallons per acre per diem, with corresponding reduction of cost of construction. The machine consists of an inverted open box four feet square by two feet deep, suspended from an electrically operated movable platform. The box contains a revolving hollow

* Eng. News, 59, 249.
† W. B. Fuller, Eng. News, 59, 287.

rake, through whose hollow teeth water is pumped. The box is lowered to the sand surface, water is forced through the rake teeth, and a suction pipe takes away the dirty water. A little extra water is continually sucked from beneath the edges of the box. This prevents stirring up the water over the filter sand, and enables the work of sand washing to be observed. It has been used with success at Yuma, Ariz., for four years. It has been recommended for the proposed Croton filters by the author, who has made extended experiments with it at the Jerome Park Reservoir, New York.

VITAL STATISTICS

By MARSHALL LANGTON PRICE, M.D.
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SOME OF THE PURPOSES OF THE SECTION. The Editor must confess that he views the approach of his duties in establishing and maintaining a new section in the AMERICAN JOURNAL OF PUBLIC HYGIENE with some trepidation. Part of this is no doubt due to the quasi-apologetic standpoint which the statistician must perforce assume in dealing with a subject held in slighting estimation by the general public, but mainly from the vast importance of the subject itself. It is such a large Goliath and the pebbles are so small and few. Statistics is a fundamental science; like other fundamentals it is often forgotten or ignored. We admire the beautiful structure, but we give no thought to its foundation hidden underground.

Knowledge is the power through which we walk, unscathed, among the powers of darkness, and Statistics is the supreme court of Knowledge; and if Statistics is the supreme court of all knowledge, Vital Statistics is the court of last resort for all knowledge of public hygiene.

Statistics has suffered most from the hands of her professed followers, but because the inner sanctuary has been violated by the profane, let not the whole temple fall into disrepute. Unlike our civil courts which guard only our property and liberty, hygiene is the guardian of our greatest possession — our lives. As the Testament puts it, "Everything that a man hath, that will he give for his life," and vital statistics must always be the supreme court of hygiene, the science of the conservation of human life. By this always delicate

and accurate instrument we can determine our errors, measure our progress, and map out our future course.

To carry out our simile, it will be the endeavor of this section to show, through the work of others, how this machine can be used to best advantage for the betterment of the public health, and how errors in its use can be best avoided and corrected.

THE IMPORTANCE OF VITAL STATISTICS. Vital statistics is the most important of statistical studies. This is true from the merely economic standpoint. All property other than real, having intrinsic value, derives its value from the population. Considering the subject from the hygienic standpoint, we can truthfully say, that all permanent hygienic advancement is founded upon data derived from the study of vital statistics. The fundamental data upon which vital statistics are founded are, the birth rate, the death rate and the duration of life. The whole purpose of public hygiene is to increase the birth rate, decrease the death rate and increase the duration of life. In vital statistics we find not only the measure of our efficiency, but the means by which we can obtain these ends.

OFFICIAL STATISTICS IN THE UNITED STATES. The official recognition by the United States Government of the importance of its vital statistics, if tardy, is no less gratifying. The attachment of the Census Bureau to the Department of Commerce and Labor is probably the best arrangement that could be made under existing circumstances. The Bureau has always ranked high among the Government services and its increased power and appropriations have already become manifest, in the later publication of the Bureau. Particularly valuable to sanitarians are the annual publications on mortality statistics. The Seventh Annual Report of Mortality Statistics for the year 1906 has been

recently issued by the Bureau of the Census. This report consists of 480 pages, containing numerous tables of mortality statistics. The summary and rate tables are particularly valuable in studying the prevalence and geographical distribution of the various diseases. The relation of color, age and sex have been tabulated with especial care. A great deal of valuable statistical information is furnished about the principal causes of death. The introduction should be read and studied by all registrars, as it points out the defects in our present system and the means by which effective returns can be secured.

PERPLEXITIES OF MORTALITY STATISTICS. Some of these have been referred to in the volume just cited, but as they are met with in all registration areas they may be briefly mentioned here. It has been stated by physiologists that no two persons see the same color in exactly the same way; for instance, the impression made by the color red on one man's retina is never exactly the same as that made on the retina of another man by the same color; in like manner, one disease may give rise to very different impressions in the minds of two physicians. This personal idiosyncrasy will be very evident to any one who examines a large number of original death records. This "personal equation," the unknown x of our philosophical algebra, must always mean more or less variation in our results. Another confusing factor is the irregular methods used by some registration officers in compiling death returns. This can naturally be more easily influenced than the "personal equation" of those making the record of death. If we add to this the different definitions given to the same disease by colloquial nomenclature in different areas we can better appreciate the difficulties with which registrars have to cope. Thus, to cite a single example, cholera morbus in France means Asiatic cholera, while in the United States the term is generally applied to the simple

colic, or other more or less serious digestive disorders due to indiscretions in diet.

SOME OFFICIAL FOREIGN STATISTICS. The *Informe Mensual Sanitario y Demografico de la Republica de Cuba*, published by the Junta Superior de Sanidad de la Isla de Cuba (the Superior Board of Health of the Island of Cuba), in Spanish and English, has been issued for the year 1906. The publication, as is to be expected, lays great stress on the returns for yellow fever. The general death rate for Cuba, assuming the mortality registrations to be correct and complete, is only 20.77 per thousand for the municipal district of Havana; 36 cases of yellow fever are reported with 11 deaths. Tuberculosis is the prominent cause of death, and judging from the mortality and morbidity returns is a serious scourge on the island. Thus during the month of September there were treated in the Special Dispensary for Tuberculosis, 10,459 cases. The highest death rate for tuberculosis was reported from the province of Consolacion del Norte, 30.38 per ten thousand. Judging from the returns of contagious diseases, notification is rather strictly observed on the island. Of interest in the birth returns are the relatively high number of illegitimate births, which comprise over two-thirds of the colored births. The infant mortality, as would be expected, is considerably higher than in the United States or Continental Europe, nearly forty per cent of the recorded deaths are under the age of five years. The total deaths for the year 1906 numbered 5,090, of which only 9 were due to yellow fever, and 967 to tuberculosis.

The Cuban Republic makes use of the International classifications of causes of death in tabulating and compiling its mortality returns.

SOME STATISTICS OF SOUTH AMERICA. The *Annario Estadistica de la Republica Oriental del Uruguay*

published biennially in French and Spanish by the Consejo Superior de Estadistica, was published in Montevideo on the 18th of July, 1907. This report is in the nature of a biennial census, and contains the general data found in American and European censuses. The section on Demography comprises one of the largest and most important sections of the volume. The International classification is employed. The work is systematically arranged and complete and profusely illustrated with colored plates. The population is estimated at 1,100,000. Full data are given regarding the population, including comparisons with the population of the principal countries of the Eastern and Western Hemispheres. The bulk of the present foreign population is Italian and Spanish, the former predominating. An interesting feature of the report are the maps of the provinces in which the birth and death rates, and death rates from the various contagious diseases, are shown. It is of interest to observe that the reversal of the seasons in the sub-equatorial zones is indicated in the mortality from affections of the alimentary tract; the highest mortality for these diseases is in December, and the lowest in August,— a complete reversal of the seasonal mortality in our temperate zones.

OUR AMERICAN BIRTH REGISTRATION. Dr. Cressey L. Wilbur, in his introduction to Mortality Statistics of the Census Bureau for 1906, makes a forceful plea for concerted effort on the part of registration areas to secure complete birth returns. The maps illustrate the argument very effectively. In these maps the registration States are indicated by dark areas. These maps show that in 1895 the registration States were limited to New England, New York, New Jersey and Delaware. In 1907 there was a substantial acquisition by the inclusion of Pennsylvania, Maryland, Michigan, Indiana, South Dakota, Colorado and California. The maps of births, however, show the same virgin unculti-

vated field in 1907 that appeared on the map of 1895. When we consider that in civilized countries the birth certificate is the basis for school attendance, voting, marriage, acquisition of property, and practically all factors concerned in civil rights, liabilities and privileges, we can only look with wonder on a country which treats one of its most important fundamentals of civilization with the contempt of the vandal for knowledge and culture; but such must, judging from practical results, be the attitude of our public opinion and our statutes towards birth registration.

STATISTICAL FALLACIES. America has the name of being a flourishing garden for the growth of statistical fallacies. To prevent the growth of statistical fallacies in the garden of figures is as difficult as to exclude garlic from a cow pasture. The lesson which statisticians must learn is the *significance of figures*. To be a statistician requires more than to be a good bookkeeper; the main essential, of course, is the same as that of any other problem in arithmetic, namely, to obtain correct figures; but to recognize their significance requires unusual discrimination and logic. This involves primarily the distinction between cause and effect. Thus if statistics indicates that the bulk of red-headed women avoid yellow and purple dresses, the simple bookkeeper may decide that red hair is due to the lack of these colors worn upon the body, while the statistician will correctly ascribe this result to the feminine perception of harmony for colors.

The first of the statistical fallacies to which I will call attention is one of the commonest in this country, that is, that the average age at death is equal to the average duration of life, or that the increase in the average age at death indicates necessarily a corresponding increase in the average duration of life. This is practically true where there is a fixed non-fluctuating population, but is not true in our average American cities, especially those in the middle West; one of the most

prominent of which constantly interprets its increased average age at death to mean an increase in the average duration of life. The history of the population of these American cities of rapid growth is practically always the same. They are established at first by young persons among whom the death rate is low, but the average age at death is also somewhat low owing to the youth of the population. In a population of this character the birth rate will be unusually high, and the average at death will fall accordingly to a low figure, owing to deaths among infants; finally, as occurs in all long-established municipalities, the number of old persons increases, and the average of death is high, though the mortality may be stationary or even increasing. To show how absolutely dependent the average age at death is on the population, we may cite as an extreme instance an island county in which the total population are the inmates of an infant asylum. In this case, though the mortality, by ages, may be below the average, the average age at death will, probably, range below two years for the county. Now let us suppose the county to abandon the infant asylum and the institution to be converted into a home for the aged. In this case the same county will give an average age at death of sixty-five to seventy years, though the mortality may be, and under these circumstances would necessarily be high.

PREVENTIVE THERAPEUTICS

By H. D. PEASE, M.D.
Director of the Antitoxin Laboratory, New York State Department of Health, Albany, N.Y.

SERUM TREATMENT OF EPIDEMIC CEREBRO-SPINAL MENINGITIS.* The authors† refer to prior work by Flexner on the use of an antiserum prepared from small animals by the treatment of them with *Diplococcus intracellularis*, in the treatment of animals infected with cultures of this organism.

They now report the results of the use on cases of epidemic cerebro-spinal meningitis of an antiserum obtained from the horse after its treatment with the specific meningococcus.

These cases occurred in the cities of New York, Philadelphia and Cleveland; Castalia and Akron, Ohio; Edinburgh Scotland, and Belfast, Ireland.

In all cases the anti-meningitis serum was administered by lumbar puncture into the subarachnoid space after the withdrawal of cerebro-spinal fluid up to as high as 90 c.c. The doses of the antiserum varied from 10 c.c. to 30 c.c., and the total amounts given ran as high as 120 c.c. in four days.

The serum was prepared as follows:

Killed cultures of a number of strains of the *Diplococcus intracellularis* were given the horse subcutaneously in increasing doses. Later doses of living meningococci were given intravenously in progressive doses, but were discontinued because of the severe reactions they produced.

* Journal of Experimental Medicine, 1908, Vol. X, 141.
† S. Flexner and J. W. Robling.

The serum is tested upon guinea pigs, against the autolyzed cultures of the organism. The results of such tests are only approximately accurate.

There were in all 47 cases of epidemic meningitis treated with this antiserum, and of these 34 recovered and 13 died.

Of the latter, four were fulminant cases and died within thirty-six hours of the onset of symptoms. Excluding these, about 80 per cent recovered when the serum was given within three days of the onset of the disease.

Other evidence shows that the epidemics in which these cases occurred had a very much greater mortality rate, eighty per cent. About one-half of the cases injected recovered by crisis.

In a few cases the active symptoms were arrested suddenly, and later there were relapses, which were again controlled by a second injection of the serum.

The authors state that the direct effect of the antiserum on the diplococci present in the exudate in the cerebro-spinal membranes is to cause their rapid degeneration and an attempted arrest of their free multiplication. Cultures from fluid obtained at later lumbar punctures are usually sterile. The authors also believe the serum has some antitoxic value as well as anti-bacterial qualities.

They discuss the question of anaphylaxis. The results in which several injections of serum were made, sometimes with long intervals between, tend to show that the danger of supersensitization is not very real, and they believe it does not need to be constant in practice.

The serum should be used early, although in the late stages it apparently brought a prolonged case to an abrupt termination.

Regarding the value of the antiserum, the authors make this statement: "No one could be less convinced of the final fact of its value than we are." On the other hand, they believe it should receive a more extended trial, and they are prepared to distribute serum for use under conditions which they will prescribe.

PUBLIC HEALTH LEGISLATION, NEWS AND NOTES

By F. H. SLACK, M.D.
Assistant Director, Boston Board of Health Laboratory

DAIRY INSPECTION IN CONNECTICUT.* The following law was enacted by the last General Assembly:

> The dairy commissioner shall make an investigation and examination of the premises of any farm or dairy, or of any place where cattle, dairy stock, or other domestic animals are kept, within this State, where any unsanitary condition affecting the products of such farm or dairy exists or is reported or suspected to exist. When any such condition shall be found by said dairy commissioner he shall notify the owner or occupant of the premises upon which said condition exists to remove or abate the same, at the expense of such owner or occupant, within such time as the dairy commissioner shall direct; and if such owner or occupant shall neglect to remove or abate such condition within said time so prescribed, he shall be fined not more than twenty-five dollars and shall pay such expense and costs as shall be incurred in such removal or abatement. The dairy commissioner is authorized and empowered to employ such assistants as shall be necessary to enforce the provisions of this act, and said commissioner and assistants shall have free access, at all reasonable hours, to all such premises and places for the purpose of making the examination and investigation provided by this act. Every person refusing such access shall be fined not more than seven dollars, or imprisoned not more than thirty days, or both.

* Bulletin Connecticut State Board of Health, March, 1908.

METHODS OF TASTING MILK. New regulation by the Board of Health of Boston, Mass.:

> At a meeting of the Board of Health the following regulation was adopted: Whereas, milk may be, and frequently is, made the carrier of typhoid fever, diphtheria, scarlet fever and other infectious and contagious diseases, and, whereas, the germs of said diseases may be imparted to milk by persons in the act of testing, by tasting or otherwise handling milk before delivery to consumers, it is, therefore, ordered: Whoever tests milk or cream which is to be offered for sale in any form by tasting shall do so by means of a spoon or piece of wood, paper, cardboard or other article, and such spoon, piece of wood, paper, cardboard or other article shall not again be used for testing milk until after being thoroughly washed and sterilized; no person shall permit his hands, fingers, lips or tongue to come in contact with milk intended for sale in any form. All persons engaged in the tasting, mixing or handling of milk for sale in any form shall, before engaging in such tasting, mixing or handling, thoroughly clean his hands and finger nails and keep them clean and dry during such testing, mixing or handling. No person shall permit his hands while wet to remain or pass over any open vessel containing milk intended for sale in any form. No person shall fill a jar, can or other receptacle with milk while the aforesaid jar, can or other receptacle is held over an open vessel containing milk intended for sale in any form. No person who has sore throat, diarrhœa, or is suffering from any other disturbance of the bowels, or has symptoms of infectious or contagious disease, shall engage in the handling of milk which is to be offered for sale or which is for sale.

PASTEUR TREATMENT, FLORIDA.* The State Board of Health has made arrangements whereby the Pasteur

* Journ. A. M. A., April 25, 1908.

treatment for hydrophobia can be given without sending the patient away from the State.

FREE ANTITOXIN, GEORGIA.* The State Board of Health announces through its secretary, Dr. Henry F. Harris, Atlanta, that on or about March 15 the Board will begin the manufacture of diphtheria antitoxin for free distribution to patients throughout the State.

STATE BOARD OF HEALTH, VIRGINIA.† By Act of the General Assembly, the present State Board of Health is legislated out of office, July 1, 1908. The new State Board of Health will consist of twelve members, appointed by the Governor, who shall be members of the State medical society, one of whom shall be chosen from each Congressional District, and in addition, two from the city of Richmond. The Governor shall appoint a Health Commissioner, who shall be executive officer of the State Board of Health. He shall be vested with all the authority of the Board and subject to such rules and regulations as may be prescribed by the Board. The Health Commissioner, with the approval of the State Board of Health, shall appoint an assistant commissioner, skilled bacteriologist, and a clerk. The State Board of Health shall establish and maintain in the city of Richmond suitable laboratories for the examination of clinical material submitted by members of the medical profession of the State, and such examination shall be made free of charge.

It shall be the duty of the State Board of Health as soon as practicable to begin the erection and maintenance of temporary or permanent buildings or camps, for the treatment of tuberculosis, in such localities as are proper, and at such sanitariums they shall provide for the treatment by the most advanced methods of the tuberculosis patients in the State, at a minimum expense to the patient.

* Journ. A. M. A., April 25, 1908.
† Bulletin Virginia State Board of Health, March, 1908.

REPORT OF BUREAU OF HEALTH, PHILIPPINE ISLANDS. The report of Victor G. Heiser, M.D., Director of Health for the Philippine Islands for the fiscal year ending June 30, 1907, contains much of interest as to the progress of sanitation under American rule:

> The effect of the sanitary reforms, which have been persistently carried out during the past few years, commenced to show in a most concrete and substantial manner during the period covered by this report. The public health has been more satisfactory than at any time since the American occupation of the Philippines, from which it is reasonable to infer that health conditions are better now than at any time for the past one hundred years or more. The death rate per thousand for the city of Manila has been reduced from 40.90 last year to 36.91; the rate for Americans being 5.59, which is a reduction of 3.75 over the previous year, and among Spaniards the rate dropped from 17.40 to 15.84.
>
> There has not been a single case of plague in the islands, and not one death from smallpox in the city of Manila. Cholera in recognizable form has disappeared entirely from the Archipelago. The provinces of Cavite, Batangas, Cebu, Rizal, La Laguna, Bataan and La Union, where heretofore there have been approximately 6,000 deaths annually from smallpox, have not reported one death from this disease. In all there have been over 2,000,000 vaccinations performed, the direct effect of which was that many lives were spared and thousands of persons were saved from being disfigured for life, and at the few places where smallpox did break out it made no headway.
>
> Great strides were made in introducing better drinking water, artesian wells being now in actual use in many of the towns of the provinces.

MISCELLANEOUS NOTES

GOOD RESULTS OBTAINED WITH THE TROMSDORFF METHOD OF LEUCOCYTE AND PUS CELL ENUMERATION IN MILK.* Dr. Rullman, the co-worker of Tromsdorff, makes an effort to lay great stress upon the good results obtained with "Tromsdorff's method for the determination of pus in milk," in the city of Munich, Germany.

This method has been adopted by the local authorities, who have accepted the standards of pus cell or leucocyte content of milk as set down by Tromsdorff and Rullman. The authorities have further distributed circulars to the milk producers and dealers, setting forth in the main the following rules and recommendations:

1. Cows which have any kind of an inflammation in one or more quarters of the udder are to be considered diseased.

2. Animals which have only one, two or three good quarters are not to be considered healthy, notwithstanding the fact that to all appearances the malady in the other quarter or quarters has ceased.

3. That milk from cows with inflamed udders must not be put in with the regular delivery and should be destroyed. (It is further stated that procedures of this kind may seem to be direct losses to the milk producer, while in reality it is to the contrary, and is a means of preventing an epidemic, and finally enormous losses to the milk industry in general.)

4. Further and finally it is recommended that should any doubt exist in the mind of the milk producer as to whether a diseased condition exists or not, samples of milk should be sent to the municipal authorities at Munich for examination. The milk is examined free of all cost to the sender.

(Abstract by Lewis W. Fetzer.)

* Milch-Zeiting, Leipzig, Jan. 25, 1908, No. 4.

COMMUNICATIONS

The Central Committee of the International Congress on Tuberculosis has announced the offer of the following prizes:

I. A prize of $1,000 is offered for the best evidence of effective work in the prevention or relief of tuberculosis by any voluntary association since the last International Congress in 1905. In addition to the prize of $1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

Evidence is to include all forms of printed matter, educational leaflets, etc.; report showing increase of membership, organization, classes reached — such as labor unions, schools, churches, etc.; lectures given; influence in stimulating local Boards of Health, schools, dispensaries, hospitals for the care of tuberculosis; newspaper clippings of meetings held; methods of raising money; method of keeping accounts.

Each competitor must present a brief or report in printed form. No formal announcement of intention to compete is required.

II. A prize of $1,000 is offered for the best exhibit of an existing sanatorium for the treatment of curable cases of tuberculosis among the working classes. In addition to the prize of $1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management and results obtained. Each competitor must present a brief or report in printed form.

III. A prize of $1,000 is offered for the best exhibit of a furnished house, for a family or group of families of the working class, designed in the interest of the crusade against tuberculosis. In addition to the prize of $1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award. This prize is designed to stimulate efforts towards securing a maximum of sunlight, ventilation, proper heating and general sanitary arrangement for an inexpensive home. A model of house and furnishing is required. Each competitor must present a brief with drawings, specifications, estimates, etc., with an explanation of points of special excellence. Entry may be made under competitor's own name.

IV. A prize of $1,000 is offered for the best exhibit of a dispensary or kindred institution for the treatment of the tuberculous poor. In addition to the prize of $1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management and results obtained. Each competitor must present a brief or report in printed form.

V. A prize of $1,000 is offered for the best exhibit of a hospital for the treatment of advanced pulmonary tuberculosis. In addition to the prize of $1,000, two gold medals and three silver medals will be awarded. The prize and medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management and results obtained. Each competitor must present a brief or report in printed form.

VI. The Hodgkins Fund Prize of $1,500 is offered by the Smithsonian Institution for the best treatise that may be submitted on "The Relation of Atmospheric Air to Tuberculosis."

The detailed definition of this prize may be obtained from the Secretary-General of the International Congress or Secretary of the Smithsonian Institution, Chas. D. Walcott.

VII. Prizes for Educational Leaflets:

A prize of $100 is offered for the best educational leaflet submitted in each of the seven classes defined below. In addition to the prize of $100, a gold medal and two silver medals will be awarded in each class. Each prize and medal will be accompanied by a diploma or certificate of award.

Competitors must be entered under assumed names.

A. For adults generally (not to exceed 1,000 words).
B. For teachers (not to exceed 2,000 words).
C. For mothers (not to exceed 1,000 words).
D. For indoor workers (not to exceed 1,000 words).
E. For dairy farmers (not to exceed 1,000 words).
F. For school children in grammar-school grades (not to exceed 500 words).

In classes A, B, C, D, E and F brevity of statement without sacrifice of clearness will be of weight in awarding. All leaflets entered must be printed in the form they are designed to take.

G. Pictorial booklet for school children in primary grades and for the nursery.

Class G is designed to produce an artistic picture book for children, extolling the value of fresh air, sunlight, cleanliness, etc., and showing contrasting conditions. "Slovenly Peter" has been suggested as a possible type. Entry may be made in the form of original designs without printing.

VIII. A gold medal and two silver medals are offered for the best exhibits sent in by any States of the United States, illustrating effective organization for the restriction of tuber-

culosis. Each medal will be accompanied by a diploma or certificate of award.

IX. A gold medal and two silver medals are offered for the best exhibits sent in by any state or country (the United States excluded), illustrating effective organization for the restriction of tuberculosis. Each medal will be accompanied by a diploma or certificate of award.

X. A gold medal and two silver medals are offered for each of the following exhibits; each medal will be accompanied by a diploma or certificate of award; wherever possible each competitor is required to file a brief or printed report.

A. For the best contribution to the pathological exhibit.
B. For the best exhibit of laws and ordinances in force June 1, 1908, for the prevention of tuberculosis by any State of the United States. Brief required.
C. For the best exhibit of laws and ordinances in force June 1, 1908, for the prevention of tuberculosis by any state or country (the United States excluded). Brief required.
D. For the best exhibit of laws and ordinances in force June 1, 1908, for the prevention of tuberculosis by any municipality in the world. Brief required.
E. For the society engaged in the crusade against tuberculosis having the largest membership in relation to population. Brief required.
F. For the plans which have been proven best for raising money for the crusade against tuberculosis. Brief required.
G. For the best exhibit of a passenger railway car in the interest of the crusade against tuberculosis. Brief required.
H. For the best plans for employment for arrested cases of tuberculosis. Brief required.

XI. Prizes of two gold medals and three silver medals will be awarded for the best exhibit of a workshop or factory in the interest of the crusade against tuberculosis. These medals will be accompanied by diplomas or certificates of award.

The exhibit must show in detail construction, equipment, management and results obtained. Each competitor must present a brief or report in printed form.

The following constitute the Committee on Prizes: Dr. Charles J. Hatfield, Philadelphia, *Chairman;* Dr. Thomas G. Ashton, Philadelphia, *Secretary;* Dr. Edward R. Baldwin, Saranac Lake; Dr. Sherman G. Bonney, Denver; Dr. John L. Dawson, Charleston, S.C.; Dr. H. B. Favill, Chicago; Dr. John B. Hawes, 2d, Boston; Dr. H. D. Holton, Brattleboro; Dr. E. C. Levy, Richmond, Va.; Dr. Charles L. Minor, Asheville, N.C.; Dr. Estes Nichols, Augusta, Me.; Dr. M. J. Rosenau, Washington; Dr. J. Madison Taylor, Philadelphia; Dr. William S. Thayer, Baltimore; Dr. Louis M. Warfield, St. Louis.

BOOK REVIEWS

A Manual of Personal Hygiene. Edited by WALTER L. PYLE, A.M., M.D. (Third Edition.) *W. B. Saunders Company, Philadelphia*, 1907.

This book is already favorably known through its earlier editions. It occupies a unique position among works of medium size, dealing with this important subject. The books with which one naturally compares it are either frankly unscientific and meant for consecutive reading, like Curtis's epigrammatic "Nature and Health" and Gulick's "The Efficient Life," or designed especially for school use, like Hough and Sedgwick's "Human Mechanism." The volume in hand is rather a collection of articles by specialists to which one may refer for scientific but practical discussions of salient questions. Its tone is moderate and sane. The error of laying down many minute rules of personal conduct, a common characteristic of magazine hygiene, is wisely avoided. The values of optimism and of variety in occupation receive timely emphasis. We commend, especially, Dr. J. W. Courtney's section on the Hygiene of the Nervous System.

P. G. STILES.

Elements of Water Bacteriology. By PRESCOTT and WINSLOW. (Second Edition.) *Wiley & Sons. Published* 1908. *Price*, $1.50.

Those interested in the bacteriological problems connected with the sanitary examination of water and sewage will welcome the second edition of this valuable work, which, though small, is so well arranged and so full of good material

and suggestion that one does not regret its size. All medical health officers should have it on their shelves. Almost the last word on the interpretation of bacteriological water analyses will be found in it. Those teaching bacteriology, especially to medical students, will find useful information with reference to this important subject, which in the ordinary text-books on bacteriology is touched on only in a cursory and incomplete sort of a way.

The work is the product of practical workers on the subject, not compilers. They have not neglected the literature. They have gone into the depth of it and its richness is striking, and, what is more, their references are critical without being carping. The authors take their readers into their confidence, speak positively where they can justly, and point out the limitations fairly where these exist, and with all keep an open mind for the good things that must yet come.

They take up the method of water collection and of bacteriological counts, the significance of the quantitative results. They go over the various methods, "presumptive and conclusive," of the *B. coli* estimation with the significance of the same. They give a good chapter on the isolation of specific pathogenes that is refreshing, also a chapter on the significance of other bacteria usually taken as indicative of the sewage pollution of a water. Their chapter on the bacteriology of sewage and sewage effluents, though not extensive, is very good.

The book ends with a valuable appendix on "Media-Making" being an extract from the Report of the Committee on Standard Methods of Water Analysis of the American Public Health Association, 1905. In the course of the work they lay special stress on the necessity of a standard in this particular. The value of published work of this class is fully useful only when it is done after such standard methods, bacteria are such alterable creatures.

JOHN A. AMYOT.

Sanitation of the Modern Home. Edited by JNO. K. ALLEN. *Domestic Engineering, Chicago,* 1907.

A suggestive guide to the architect and house owner in designing and building a residence providing a healthful, comfortable and convenient home.

The following list of chapters will give an idea of the scope of the book:

Chapter I, Selection of Building Site; Chapter II, Preparation of the Soil; Chapter III, The Ideal Home; Chapter IV, What the Modern Housekeeper Wants; Chapter V, The Cellar; Chapter VI, The Laundry; Chapter VII, Heating by Steam; Chapter VIII, Heating by Hot Water; Chapter IX, Heating by Warm Air; Chapter X, Ventilation; Chapter XI, Temperature Control; Chapter XII, Cold Water Supply; Chapter XIII, Hot Water Supply; Chapter XIV, Kitchen; Chapter XV, Bathroom; Chapter XVI, Lighting the Home; Chapter XVII, The Stable; Chapter XVIII, Electricity in the Modern Home.

This is a most excellent book of its kind. The authors of the various chapters are evidently well acquainted with the best practice and the whole book is written in a clear and forceful manner. Especially good are the chapters on heating, ventilation and plumbing. The last chapter gives one a very good idea of the uses of electricity, especially in heating and cooking. From a public health standpoint the title of the book is a little misleading. It would give one an idea that it was a work on hygiene, while really it is a description of modern methods for equipping a home "with a good system of cold and hot water supply, an inoffensive and sanitary system of disposing of household wastes, an adequate system of automatically controlled heating combined with ventilation, and a convenient and complete scheme of artificial lighting." All of these, of course, when well carried out may be attributes of a sanitary home, but a book with this title would naturally

be more concerned, for example, with the quality of the water supply of the house than with the pipes and fittings used in its distribution. Generally speaking, the subject matter of the book is in accord with the best modern practice. It is, however, to be regretted that no mention is made of the danger of illuminating gas in sewers, as this is far more deadly than sewer air, which has been proved by many investigations to be as pure, if not purer than the air of the streets above the sewers.

In the chapter on lighting a little more might have been said on the effect of distributed light upon the eyes, as compared with light supplied from one or more centers of intense illumination.

In the chapters on plumbing there is a welcome tendency away from a multiplicity of traps and toward simplicity in design. It would seem to the reviewer, however, that a little more emphasis might be placed upon seat vents for closets, because they certainly contribute to the purity of the air in bathrooms and bedrooms to which they are attached. We see no reason why catch basins should be water-tight, provided the soil is porous and there is no danger of water leaching from catch basins to cellar. Again, there is no objection to the use of blind drains for rain-water leaders, provided a like precaution is taken.

The chapters on heating are very well written. The advantages and disadvantages of each system are described in a most judicial manner. No mention is made of ordinary stoves, which must necessarily be used by the majority of people, and the design of which might be improved upon very much.

The book describes many excellent ways of equipping a a healthful home, but a healthful home for those in quite comfortable circumstances. Many appliances, for example, low-cost shower baths, which are so cheap as to be within the reach of almost all, yet permissible from a sanitary standpoint,

although somewhat deficient in appearance and convenience, might have been mentioned in the book. It has seemed to us that there has always been a lack of proper sanitary conveniences for the benefit of the impecunious many, rather than of refined appliances for the benefit of the wealthy few.

With these few comments and with the classification of the book among works on the sanitary arts, rather than among those on hygiene, we can heartily recommend it to all those concerned or interested in the proper equipment of the modern home.

R. S. WESTON.

Milk and its Relation to the Public Health. (*By various authors.*) *Hygienic Laboratory Bulletin No.* 41. *Government Printing Office, Washington,* 1908.

This Bulletin of 750 pages is a symposium by Trask, Lumsden, Anderson, McCoy, Stiles, Eager, Kastle, Roberts, Rosenau, Miller, Kerr, and Schereschewsky of the U.S. Public Health and Marine Hospital Service, Wiley, Mohler, Webster, Bolton, Melvin of the Department of Agriculture, and Dr. Wm. C. Woodward, Health Officer of the District of Columbia, with an introduction by Dr. Walter Wyman, head of the U.S. Public Health and Marine Hospital Service.

The articles relate to the present status of the milk problem from many standpoints, and treat of milk-borne outbreaks (typhoid, diphtheria, scarlet fever, tuberculosis, malta fever, zoo-parasites, summer diarrhœa); of the composition of ice cream, and milk; of the bacterial content of milk, and the presence of leucocytes; of the proper care of the cow, the securing of cleanliness, cold and rapid transit; of the proper classifications of market milk, with discussions of pasteurization, infant feeding and municipal regulation of milk

supplies; and a series of tables, blanks, forms for inspection of dairies, and the statutes and regulations pertaining especially to the District of Columbia.

This symposium, curiously enough, is the outcome of the endemicity of typhoid in the District of Columbia, on which Government reports and investigations have been proceeding for years. Having eliminated water as a source of the Washington typhoid, by the elaborate and costly but certainly effective method of filtering all the water, and then observing that the typhoid fever remained at its old level, the Government proceeded to the investigation of the milk, and the rest of the country may well thank the long-suffering Washingtonians that their martyrdom, for Lo! these many years, has resulted, at least, in the production from the Government printing offices of a very fine text-book on milk — the application of one-tenth the contents of which, in practice, should have abolished this disgrace of the National Capitol a decade since. The professional hygienists have again demonstrated that an epidemiological diagnosis in the hands of experts does not require ten years and an immense investment to eliminate a single factor by a roundabout process, but that professional knowledge, commonplace enough to professionals, *and action*, may achieve the result in as many months.

The introduction reiterates the catchword, often emphasized in the last few years, that the factors of good milk are "cow, cleanliness, cold and quickness." A most interesting series of 260 milk-borne epidemics is summarized and tabulated by Dr. Trask, no doubt but a small fraction of those which have occurred. Dr. Lumsden points out the epidemiological features diagnostic of milk-borne typhoid outbreaks — an article well worthy of special attention by all health officers concerned in such outbreaks.

Dr. Anderson sketches the tubercle bacilli in the milk problem, indicating general use of the tubercular test for cows as the remedy.

Dr. McCoy deals with the milk-sickness, a disease of the human associated with drinking milk from cows suffering from the "trembles."

Dr. Stiles discusses, and eliminates as a practical factor, the probability of transfer of tapeworms, etc., through the milk supply, indicating the possibility, under some combinations of circumstances, of occasional transfer of some forms.

Dr. Eager gives some morbidity and mortality statistics relating to milk consumption.

Dr. Wiley indicates that "ice cream" is a term of indefinite application, to be interpreted only as meaning a frozen substance or mixture, without prejudice as to its contents. When it contains cream, milk or milk products, these should come from clean cows.

Dr. Kastle gives an exhaustive account of milk chemistry, including that of decomposed milks, a valuable contribution to the subject.

Dr. Rosenau treats of bacterial counts and standards giving the methods used in Washington. Reference to the Report of the Committee on Standard Methods of Bacterial Milk Analysis is conspicuous by its absence, and in considering the milk of other cities, no mention is made of any results later than 1904, although Boston and some other cities have contributed an immense number of examinations, exhaustively tabulated, since that date.

Dr. Rosenau and Dr. McCoy reach some valuable conclusions as to the so-called germicidal qualities of fresh raw milk, showing that it is weakly and variably antiseptic rather than germicidal.

Dr. Miller gives some conservative conclusions regarding the status of the question of leucocytes and streptococci in cow's milk, not markedly different from the general concensus of opinion amongst experts at this time.

Dr. Mohler lists and discusses as diseases of the cow injuriously affecting milk, tuberculosis, actinomycosis, botry-

onycosis, foot and mouth disease, anthrax, cowpox, rabies, mammitis, gastro-enteritis, "the trembles," and septic or febrile conditions. He considers also the origin of ropy, bitter, colored and bad-tasting or bad-smelling milks, and milks where the poison is derived from the food of the cow. Colostrum is said to produce diarrhœa, colic, etc., in those drinking it.

Sanitary inspection is described in detail by Dr. Webster, with many photographs and suggestions for reformation of existing conditions.

B. Meade Bolton describes in detail the important matter of proper water supplies for dairies and farms, and outlines the methods of examinations used and those dairies contributing to the Washington supply. A compact outfit for field bacteriological work is described. He concludes that few of the dairies or farms examined showed ideal conditions, but that in most instances simple methods would secure correction of the sanitary imperfections.

Mr. Melvin advises a recognition of the classification of milk which has grown up in the last few years; as certified milk (less than 10,000 bacteria per c.c.), inspected milk (less than 100,000 bacteria per c.c.) and pasteurized milk. He advises that all milk over 100,000 bacteria per c.c. should be pasteurized, and would not therefore admit the fourth grade, now quite widely accepted as marketable, *i.e.*, that under 500,000 bacteria per c.c.

Dr. Kerr considers at length Milk Commissions, Municipal Milk Depots, etc., giving the working constitution and rules of some existing commissions and advising official action on the subject.

Pasteurization is discussed by Dr. Rosenau, with the conclusion, apparently, largely based on statements of Theobald Smith, in this Journal, May, 1907, that pasteurization should be applied to all but the best grades of milk—a conclusion considerably at variance with most American, European and

English authorities, and yet to be tested in practice on a large scale.

Dr. Schereschewsky's article on infant feeding, in addition to other matter, deals at length with the same subject, pointing out that the dangers of scurvy or rickets from pasteurization are exaggerated, and easily offset in any case by associated diet or treatment with orange juice.

Dr. Woodward outlines the methods now in force for the supervision of the Washington milk supply, giving also their historical development.

In conclusion, we may characterize this Bulletin as a monumental aggregation of reliable information, contributing little new, but furnishing a most useful reference book, and summarizing on each subject what may be considered the "official view," although there is no claim made that it represents more than an effort to collect and publish data. Valuable advice is given, or may readily be deduced, and the whole is written clearly and concisely. It is probably the most important symposium on a public health subject from a public health standpoint yet issued by Federal public health officials, and as such is to be welcomed as a promise of good things to come as well as a good thing in itself. Inasmuch as it involves and is based upon a local study of Washington conditions, but uses this local material as an item in a broad study of interrelated questions, bringing to bear upon them the experiences of other places, it furnishes an excellent example to the local health officer of the value of local work, handled broad-mindedly and with reference to general principles as well as to immediate local needs—perhaps the most valuable of its lessons, excellent as the actual material published is in itself.

H. W. HILL.